

# SOME LEPIDOPTERA LIKELY TO BE CONFUSED WITH THE PINK BOLLWORM

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## INTRODUCTION

The purpose of the present paper is to define the characters which will distinguish the larva and pupa of the pink bollworm, *Pectinophora gossypiella* Saunders, from those of other Lepidoptera attacking cotton or related malvaceous plants and of still others feeding on plants other than malvaceous but frequently found in the neighborhood of cotton fields. A few (*Dicymolomia julianalis* Walker and *Crocidosema plebeiana* Zeller, for example) so closely resemble the pink bollworm in their habits and their larval stages that they are only to be distinguished by a careful examination of their structure. It is hoped that the present paper will make the differentiating characters clear and will enable entomological workers to distinguish the forms treated.

The field work upon which this paper is based was conducted throughout the area in southeastern Texas where the pink bollworm has been found to occur, as well as in Cameron County, at the southern extremity of the State. Special attention was devoted to discovering whether the pink bollworm was attacking plants other than cotton. Thousands of seed pods of okra and other malvaceous plants were examined. In one case, at Smiths Point, in Chambers County, all the seed pods of a plant related to cotton (*Hibiscus lasiocarpus*), growing in the immediate vicinity of a field where a heavy infestation by the pink bollworm had occurred during a previous year, were removed and given minute examination. Similar investigations were made with reference to other wild and cultivated malvaceous plants growing in or about fields where the

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<sup>1</sup> This study was conceived and arranged by Dr. W. D. Hunter, in charge of the Pink Bollworm Eradication, to aid the work of his inspectors. To the necessary preliminary field work the following entomologists were detailed by Dr. Hunter: H. C. Hanson, J. D. More, E. L. Diven, A. C. Johnson, and Carl Heinrich. For a short period Mr. Herbert Barber was also associated with the work. The material and notes on which the paper is based are all due to these workers. Especial mention should be made of Emerson Liscum Diven, who had a major part in the investigations and who lost his life in an aeroplane accident while scouting for cotton areas and who, had he lived, would have worked up the results as here given.

With the exception of Plate 107, all the drawings accompanying this paper were made under the writer's supervision by Mr. H. B. Bradford, of the Bureau of Entomology. Plate 107 (also originally by Mr. Bradford) is reproduced from Busck's article on the pink bollworm (*In Jour. Agr. Research*, vol. 9, no. 10, p. 343-370, 1917). The writer is especially indebted to Mr. Bradford for his painstaking and accurate drawings.

To Mr. Busck the writer is indebted for many helpful suggestions and both to him and to Dr. Dyar for verification of some of the identifications.

pink bollworm had been found. In no instance was the pink bollworm found in any plant other than cotton.

Thirty-eight species are considered here. Of these, six are described as new, and four, already described, are recorded for the first time from the United States. In each case the male genitalia of the type specimen of the new species are figured. The essential larval and pupal characters are referred to in the text as fully as possible, and purely descriptive matter is reduced to a minimum.

#### FAMILY GELECHIIDAE

##### PECTINOPHORA GOSSYPIELLA (SAUNDERS), THE PINK BOLLWORM

(PL. 101, A, B; 103, A; 105, C, E; 106, A; 107, A-D)

*Depressaria gossypiella* Saunders, 1843, in Trans. Ent. Soc. London, v. 3, pt. 4, p. 284-285.

*Pectinophora gossypiella* Busck, 1917, in Jour. Agr. Research, v. 9, no. 10, p. 343-370.

Inasmuch as the immature stages of the pink bollworm have been already fully described in an earlier number of this journal<sup>1</sup> it will be necessary here only to point out the structural characters which will serve to identify its larva and pupa and distinguish them from those of other Lepidoptera which, because of their habits, food plants, or general appearance, might be mistaken for *Pectinophora gossypiella*. There is no easy and ready-made method which will enable a layman to distinguish an insect and be certain of its identity. This applies with particular force to the pink bollworm. As Busck well states—

Definite and final determination of *P. gossypiella* in any stage can be made only by the aid of a microscope

and he might have added, only by one reasonably experienced in insect determination and familiar with the characters used in classifying Lepidoptera. Nevertheless the pink bollworm has structural characters by which it can be determined and its identity established beyond the possibility of doubt. The specialist alone can pass upon these with certainty; but the average intelligent worker in the field can also use them, far enough at least to say what larvæ or pupæ commonly found in and about cotton fields can not be *P. gossypiella*.

The combination of the following characters distinguishes the larvæ of the pink bollworm:

Three setæ (III, IV, and V) triangularly grouped on the prespiracular shield of the prothorax (Tr). (Pl. 103, A.)

Setæ IV and V closely approximate on the proleg-bearing abdominal segments (AIII). (Pl. 103, A.)

Setæ III above (not directly before) the spiracle on the eighth abdominal segment (AVIII).

<sup>1</sup> BUSCK, August. THE PINK BOLLWORM, PECTINOPHORA GOSSYPIELLA. In Jour. Agr. Research, v. 9, no. 10, p. 343-370, 7 fig., pl. 7-12. 1917. Literature cited, p. 366-370.

On the ninth abdominal segment (A<sub>IX</sub>) the paired dorsal setæ II not on a single pinaculum (chitinized plate) and not appreciably closer together than the paired I on the dorsum of the eighth abdominal segment; seta I no nearer to III than to II; VI closely approximate to IV and V; group VII unisetose.

Prothoracic legs appreciably separated at their base. No anal fork on tenth abdominal segment. Crochets of abdominal prolegs uniordinal and arranged in a circle broken outwardly. (Pl. 106, A.)

On each side of the thoracic shield near Seta I<sup>b</sup> a small crescent or reniform spot (Pl. 103, A) paler than the surrounding chitinized area.

On the epicranium the lateral seta (L<sup>1</sup>) behind the level of P<sup>1</sup> and remote from A<sup>3</sup> (that is, farther from A<sup>3</sup> than A<sup>3</sup> is from A<sup>2</sup>) and the anterior puncture (A<sup>n</sup>) lying between setæ A<sup>1</sup> and A<sup>2</sup>. (Pl. 101, A.)

Each of these characters is possessed by other lepidopterous larvæ, but their combination is peculiar to *Pectinophora gossypiella*. No other known larva that we have in this country possesses them all. I have not seen caterpillars of (*Gelechia*) *Pectinophora malvella* Zeller,<sup>1</sup> the only other known species of the genus *Pectinophora*, or of *Platyedra vilella* Zeller, which Meyrick considers congeneric with *Pectinophora gossypiella*.<sup>2</sup> These may have most or all of the structural characters here given, but as neither of them occurs outside of the Old World they do not concern us at present.

The setal characters are fully illustrated on Plates 101, 103, and 105. It will be noted that two slight changes have been made from the drawings published in Busck's paper. The numbering of abdominal setæ IV and V has been reversed to correspond with our present conception of the homologies of these setæ; and the lateral puncture (L<sup>a</sup>) of the epicranium is shown directly posterior to rather than postero-ventrad of seta L<sup>1</sup>. In Busck's figures<sup>3</sup> the puncture is much too low.

The pupa (Pl. 107, A-D) is evenly and densely clothed with a fine pubescence; moderately stout, with a short, hooked cremaster surrounded by 6 to 8 stout, hooked setæ but *without* dorsal spines or other armature; labial palpi absent; maxillary palpi long, extending four-fifths of the wing length; antennæ long but not quite reaching to tips of wings; vertex distinct but narrower than prothorax.

No other lepidopteron feeding on malvaceous plants in this country has such a pupa. The fine pubescence and short, hooked cremaster are easily discernible under a small hand lens and are enough to identify the pupa which, when once seen, is not likely to be confused with that of any other cotton-feeding species.

<sup>1</sup> After this paper had gone to the printer we received from the Abbé J. de Joannis of Paris a larva of *Pectinophora malvella*. The structural characters are the same as those of *Pectinophora gossypiella*.

<sup>2</sup> The Abbé Joannis also sent us a male moth of *Platyedra vilella*. A comparison of the genitalia of this and *Pectinophora gossypiella* does not support Meyrick's contention.

<sup>3</sup> BUSCK, August. OP. CIT., 1917, p. 348, fig. 2, B.

## GELECHIA HIBISCELLA BUSCK

(PL. 93, C)

*Gelechia hibiscella* Busck, 1903, in Proc. U. S. Nat. Mus., v. 25, p. 869-871.*Gelechia hibiscella* Busck, 1903, in Dyar, List North Amer. Lep., no. 5739.

This species was originally described from larvæ collected on *Hibiscus moscheutos* in the vicinity of Washington, D. C.

On the shores of Miller's Lake and Lake Charlotte in Chambers Co., Tex., we found the larvæ fairly abundant in early September (1918) on both *Hibiscus lasiocarpus* and *H. militaris* and also occasionally on *Kosteletzkyia* spp. During October of the same year adults were reared from these. The male genitalia compared with those of typical specimens from the type locality agree in all details. A figure of the elaborate and characteristic genitalia is given in Plate 93, C.

*Gelechia hibiscella* seems to be limited in food plant to *Hibiscus* and one or two other closely allied Malvaceae. We have never found it on cotton or okra, but there seems to be no reason why it should not thrive on these. The feeding habits vary somewhat according to the characters of the plant on which the larvæ feed. On the broader-leaved *Hibiscus moscheutos* around Washington and the similar *H. lasiocarpus* in Texas the larvæ feed chiefly on the leaves, rolling them up and partially biting through the stems before pupation so that the folded leaf is easily shaken to the ground by a slight wind. Within this roll they pupate. Occasionally the larvæ also attack the seed pods, but from the writer's observation this is rather rare in the broad-leaved species of *Hibiscus*. In the narrow-leaved *H. militaris* and in *Kosteletzkyia* spp., on the other hand, the habits are quite different. Here the larvæ feed chiefly in the flowers and seed pods, pupating in the withered flowers, and do not attack or use the leaves at all.

There is no possibility of confusing this species with *Pectinophora gossypiella*. The larvæ as well as adults of the two are very different. In *Gelechia hibiscella* the body of the larva from the beginning of the metathoracic segment to the caudal end is white, longitudinally marked with continuous, narrow, somewhat wavy, reddish brown stripes; one pair on the dorsum, lying between the paired setæ I; one subdorsal stripe on each side, above seta III, and a lateral stripe in the spiracular area. Except on the metathoracic and ninth abdominal segments none of the body tubercles are touched by the longitudinal stripes but lie between them on the white areas. The first two thoracic segments are reddish brown with the anterior portion of the mesothorax white above. The anal shield is yellow; the thoracic legs and prothoracic shield are black. The chitinizations about body tubercles moderate but conspicuous, black or blackish brown, rounded or oval, and sharply defined; crochets of prolegs uneven biordinal and in a complete circle, 32 to 36, brown; anal fork present, rather stout, 6- to 8-pronged; head yellow-brown,

more or less suffused and mottled with black; ocellar pigment black, continuous under all the ocelli. Full-grown larvæ 22 to 23 mm. long.

The only caterpillar treated in this paper which could easily be confused with this species is that of *Gelechia neotrophella* Heinrich. The latter, however, is at once distinguished by its 2-pronged anal fork and the fusing of the middorsal stripes on most of the abdominal segments.

#### GELECHIA BOSQUELLA CHAMBERS

*Gelechia bosquella* Chambers, 1878, in Bull. U. S. Geol. Surv. Terr., v. 4, p. 87.  
*Gelechia bosquella* Busck, 1903, in Dyar, List North Amer. Lep., no. 5729.

A single moth of this species was reared September 23, 1918, from *Cassia tora* infested by larvæ of *Platynota rostrana* Walker, collected at Turtle Bayou, Tex. This species is not a malvaceous feeder and is only mentioned here on account of the similarity of its larva to those of two other species treated in this paper, *Borkhausenia diveni* Heinrich and *Noctuella rufofascialis* Stephens. It is very strikingly colored, the three thoracic segments being a bright wine-red while the rest of the body is green. The head, legs, thoracic shield, and body tubercles are black. The red coloring of the thoracic segments, however, is not continuous as in the two species just mentioned but is broken on the anterior portion of the meathtorax by a broad encircling band of the greenish body color.

A detailed technical description of the larva is given by Dyar in Busck's revision of the American Gelechiidae.<sup>1</sup>

#### GELECHIA NEOTROPHELLA, N. SP.

(PL. 94, C-G; 105, H)

##### *Gelechia neotrophella*, n. sp.

Antennæ black. Palpi black, dusted with white. Face black, very slightly dusted with white. Head and thorax black, heavily dusted with white. Forewings black, marked with overlaid white scales; the white dustings over the black forming an oblique, basal grayish-white patch wider on dorsum than on costa, an obscure, rather broad median fascia consisting of a narrow, oblique median streak clouded with grayish before and behind, and a short white geminate costal dash at apical fourth; cilia smoky blackish fuscous. Hindwings and cilia pale smoky fuscous, somewhat shaded with black toward apex. Legs black, dusted and annulated with white. Male genitalia of type as figured (Pl. 94, C-G). Alar expanse 12 to 13 mm.

HABITAT.—Brownsville, Tex. (Diven and Heinrich).

FOOD PLANT.—*Mimosa berlandieri*. Larva a leaf-tier, spinning a tube of silk as it feeds and so binding the leaves together.

TYPE.—Cat. No. 23739, United States National Museum.

Described from one male type and two male and six female paratypes. Two generations were noted. From larvæ collected February 3, 1919, moths issued March 5, and from larvæ put in rearing early in May, 1919, adults emerged toward the end of the same month.

<sup>1</sup> BUSCK, August. A REVISION OF THE AMERICAN MOTHS OF THE FAMILY GELECHIIDAE, WITH DESCRIPTIONS OF NEW SPECIES. In Proc. U. S. Nat. Mus., v. 25, no. 1304, p. 864-865. 1903.

The larva is yellowish white, longitudinally striped with wine-red; one rather broad middorsal stripe dividing into two thin parallel stripes from the second abdominal segment forward; one moderately broad subdorsal and one lateral stripe extending from hind margin of prothorax and fusing on the ninth abdominal segment and forming on the tenth a dark border around the outer edge of the anal shield; in the area of seta VI a similar narrow sublateral stripe; head and thoracic shield pale yellow; crochets of prolegs 28 to 34, biordinal and arranged in a complete circle; anal prolegs with a conspicuous blackish red chitinated spot on caudal side; anal fork rather large, 2-pronged; full-grown larva 8 to 8.5 mm. long.

The species is close to and strikingly resembles *Gelechia trophella* Busck, from which, however, it is easily distinguished by the male genitalia. The structural differences are shown in Plate 93, A and B, and in Plate 94, C-G.

The larva is not in any way to be confused with the pink bollworm, from which it differs strikingly in superficial appearance. It resembles somewhat the larva of *Gelechia hibiscella* Busck but is separable from that species by food plant and structure. In *G. neotrophella* the anal fork is 2-pronged, while in *G. hibiscella* it has from 6 to 8 distinct prongs. In the latter, also, the dorsal stripes are nowhere fused.

TELPHUSA MARIONA, N. SP.

(PL. 94, A, B; 105, F; 109, G)

**Telphusa mariona**, n. sp.

Antennae black. Palpi cream-color, shading to white on upper side of second joint; apical half of third joint and upper side of basal joint black. Face white. Head and thorax cream-yellow. Forewings glossy black with two conspicuous cream-colored spots; one, a short triangular dash on outer third of costa; the other, an irregular spot of about the same size on dorsum just beyond middle; in some specimens two or three minute and obscure patches of white or cream-colored scales along termen; cilia blackish. Hindwings and cilia smoky fuscous. Legs black, ringed at outer margins of the joints with cream-yellow or white. Male genitalia of type as figured (Pl. 94, A, B). Alar expanse 9 to 11 mm.

HABITAT.—Brownsville, Tex. (J. D. More and H. C. Hanson).

FOOD PLANT.—*Abutilon incanum*. Larva a leaf-folder. Also taken on *Abutilon berlandieri*, *Malvastrum* sp., *Wissadula* sp., and *Sida* sp.

TYPE.—Cat. No. 23740, United States National Museum.

Described from male type and 25 male and female paratypes reared from larvæ collected in late March and early April, 1919, on *Abutilon incanum*. Moths issued from middle of April to middle of May, 1919.

Larva, full-grown, 6.5 to 7 mm. long; slender. Body yellowish white with a subdorsal and a lateral longitudinal row of large red blotches and a longitudinal row of smaller red spots on the level of seta VI and just anterior to that seta on each segment; on the eighth abdominal segment the paired subdorsal spots are fused and on abdominal segment 9 the

subdorsal and lateral spots are also fused; legs pale yellow; crochets light brown, 18 to 20 in a complete circle, unevenly biordinal; thoracic shield divided by a thin median longitudinal pale line, yellow with a broad shading of fuscous on the lateral extremities and a smaller fuscous patch at the center of the anterior dorsal margin; anal shield yellow laterally shaded with fuscous; other chitinated areas smoky fuscous, tubercles moderately chitinated; hairs moderately long, slender, yellowish. Head light yellow with a narrow black shading at posterior lateral incision of hind margin and a similar black dash on ventral margin of epicranium adjacent to triangular plate of hypostoma; ocellar pigment black, continuous under all the ocelli.

The larva is very similar in superficial appearance to the scavenger worm (*Pyroderces rileyi* Wlsm.). It differs most strikingly in the arrangement of the red markings, which are in spots or blotches rather than in continuous bands, and in the possession of a well-developed anal fork (Pl. 105, F) entirely lacking in *P. rileyi* and the pink bollworm.

The pupa is easily distinguished from those of the other Lepidoptera treated in this paper by the peculiarly scalloped and fringed posterior margin of its eighth abdominal segment. (Pl. 109, G.)

#### ISOPHRICTIS SIMILIELLA (CHAMBERS)<sup>1</sup>

(PL. 95, A; 102, F)

*Gelechia similiella* Chambers, 1872, in *Canad. Ent.*, v. 4, p. 193.

*Paltodora similiella* Busck, 1903, in *Dyar, List North Amer. Lep.*, no. 5548.

In the dead flower heads of *Rudbeckia* sp. (commonly called "nigger heads" in many parts of Texas) there are two species of lepidopterous larvæ which many nonentomologists have confused with *Pectinophora gossypiella*. One of these when mature is about the same size as and superficially like a full-grown pink bollworm. It is an olethreutid, however, and as such is easily distinguished by the setal arrangement of the ninth segment which readily separates the two families Gelechiidae and Olethreutidae. In the former the paired setæ II on the dorsum of the ninth segment are no closer together than the paired setæ I on the dorsum of abdominal segment 8 (Pl. 105, C) and I is as near II as it is III on the ninth abdominal segment. In the Olethreutidae, on the other hand, the paired II on the dorsum of the ninth abdominal segment are on a single chitination and *closer together* than the paired I on the eighth abdominal segment. Also I and III are closely approximate (Pl. 105, B). We have not succeeded in rearing the moth, so specific determination can not be given. The family position of the larva, however, is certain.

<sup>1</sup> The genus *Isophrictis* has been erected by Meyrick for those species formerly listed under the genus *Paltodora* Meyrick having the second joint of the labial palpi clothed beneath with long rough spreading hairs and having veins 7 and 8 of forewings out of 6. It replaces *Paltodora* for the North American species. (MEYRICK, E. ON THE GENUS *PALTODORA*. In *Ent. Mo. Mag.*, v. 53, no. 636 [s. 3, v. 3, no. 29], p. 113. 1917.)

The other *Rudbeckia* feeder (*Isophrictis similicella* Chambers) belongs to the same family as the pink bollworm and is much more abundant and less local than the *olethreutid*. It feeds on the seeds of a number of *Compositae* and is frequently found in sunflower heads. The larva when mature often has a pinkish tinge and somewhat resembles an immature pink bollworm except for its shape, which is distinctly spindle-like, sharply tapering at both ends and decidedly stout for its length (1.5 to 2 mm. wide by 5 mm. long in full-grown specimens). The arrangement of the setæ of the anterior group on the epicranium is also characteristic;  $A^1$ ,  $A^2$ , and  $A^3$  are crowded very close together on the anterior dorsal part of the head and  $I^1$ , while remote from  $A^3$  as in most *Gelechiidae*, is well forward near the ocelli. (Pl. 102, F.)

The pupa shows under the microscope a slight pubescence similar to that of *Pectinophora gossypiella* but this is limited to the head alone. Otherwise, except for the normal setæ and a sharp, thorn-like, dorsally projecting cremaster, the pupa is smooth. It is short and moderately stout (1.5 mm. broad by 5.5 to 6 mm. long) with the wing cases reaching nearly to and the metathoracic legs extending a trifle beyond the tip of the abdomen.

Several moths of this species were reared from larvæ collected at various points in Chambers County and in the neighborhood of Galveston and Houston. Larvæ were collected in late August and early September, 1918, and adults issued from these from the middle to the end of September the same year. Other larvæ, taken in October of 1918, produced moths the following May, passing the winter as pupæ within the dried flower heads.

The male genitalia of the moth are figured in Plate 95, A.

#### FAMILY OECOPHORIDAE

##### BORKHAUSENIA DIVENI, N. SP.

(PL. 96, C-F)

##### *Borkhausenien diveni*, n. sp.

Antennæ white, faintly annulated with fuscous above. Palpi blackish fuscous, broadly banded at base and apex of third joint with white; inner sides somewhat dusted with white scales. Face white. Head white with a slight suffusion of fuscous at vertex. Thorax white, heavily dusted with blackish fuscous; tegulæ white, basal half blackish fuscous. Forewings white, suffused and mottled with pale brown and black scales, the brown suffusion obscuring most of the ground color at the base and beyond the middle of the wing; an irregular black spot at base of costa; a similar black spot on lower vein of cell close to base; above and below it two smaller black spots; at middle of wing a straight, rather broad, vertical fascia of blackish brown scales inwardly margined by a distinct line of the white ground color; in the middle of this fascia a round spot of distinctly paler brown scales with the black scales edging it slightly raised; on costa just beyond median fascia a poorly defined triangular patch of brown and blackish scales; a small black dot at upper outer angle of cell and several small obscure dark spots near tornus; cilia dirty white. Hindwings and cilia grayish



fuscous. Legs fuscous on outer sides; banded with white on middle of tibiae and at ends of joints; white on inner sides. Male genitalia of type figured (Pl. 96, C-F). Alar expanse 12 to 13 mm.

HABITAT.—Brownsville, Tex. (E. L. Diven).

FOOD PLANT.—*Lantana horrida*. "Larvæ making a narrow blotch mine at the edge of the leaf and curling the edge near base, pupating within the mine" (Diven note).

TYPE.—Cat. No. 23741, United States National Museum.

Described from male type and one male and three female paratypes reared from larvæ collected April 22, 1919. Moths issued April 27 to May 5, 1919. Named in honor of the late Emerson Liscum Diven.

The larva when full-grown is 7.5 to 9 mm. long; white, with the thoracic segments and the anterior portion of the first abdominal segment a brilliant wine-red; in fully fed specimens there is often a pinkish suffusion on the dorsum of the abdominal segments; thoracic shield yellow, posteriorly and laterally edged with dark brown; anal shield pale yellow; other chitinated portions of thoracic segments dark brown; thoracic legs blackish brown, paler on inner sides; body tubercles deep brown, minute; setæ pale, slender, moderately long; crochets of prolegs dark brown, 24 to 26, biordinal and in a circle broken outwardly; spiracles pale yellow, small, round, inconspicuous; no anal fork; head pale yellow with a dark brown band on each side, extending from the ocelli to the lateral incision of the hind margin; ocellar pigment black, continuous under the ocelli.

The pupa is rather stout and short, 1.5 to 2 mm. wide by 4.5 to 5 mm. long; pale yellow-brown; smooth; caudal end rounded; cremaster absent; wings and antennæ extending to anterior margin of sixth abdominal segment; labial palpi clearly defined but small, *not* extending to proximo-lateral angles of maxillæ; between genital and anal openings a divided, blackish, chitinated rise, without spines, hairs, or other armature.

This species is easily distinguished from the other American forms in the genus by the straight median fascia. I have placed it in *Borkhausenia* advisedly, although strictly speaking it does not belong there. In any further revision of the Oecophoridae, *Borkhausenia divini* with *B. conia* Wlsm., *B. fasciata* Wlsm., *B. episcia* Wlsm., and probably *B. orites* Wlsm., will have to be placed in a new genus. While agreeing with the type of *Borkhausenia* (*B. minutella* L.) on venational characters, they differ markedly in genitalia. In *B. minutella* (Pl. 96, A, B) the harpes are typically oecophorid and laterally placed, the uncus present though small, the eighth abdominal segment simple, and the entire apparatus symmetrical. In *B. diveni* and its allies, on the other hand (Pl. 95-97), the eighth abdominal segment is distinctly modified, the uncus is absent, the harpes more ventrally placed, and the genital apparatus consistently asymmetrical. The characters of their genitalia are those of the genus *Triclonella* Busck, from which the species are separable on venation, *B. diveni* and its allies having 5 of the hind wing distinctly separate at base from the stalk of 3 and 4. The presence of a few raised scales on

the forewing would seem to throw *B. diveni* into Meyrick's genus *Erysip-tila*. The latter, however, is again distinct on characters of genitalia on which it will have to be retained and recharacterized, as the raised scale character does not seem to hold. It is possessed by *B. diveni* but not by the other closely allied species (*B. conia*, *B. fasciata*, etc.). The genus *Erysip-tila*, while similar to these in some genitalic characters (for example, the peculiar development of fused and armed soci and gnathus) and thus separable from the genus *Borkhausenia*, has the organs symmetrical throughout and the harpes laterally rather than ventrally placed. Of the North American species now listed under the genus *Borkhausenia* only three (*B. pseudospretella* Staint., *B. haydenella* Chambers, and *B. ascriptella* Busck) agree with the type species on all characters. For the present, however, *B. diveni* and its allies may be retained in that genus. Until the entire family can be revised along lines suggested by the develop-ment of genitalic structures there is nothing to be gained by erecting a single genus on these characters.

#### FAMILY STENOMIDAE

##### AEDEMOSES HESITANS WALSINGHAM<sup>1</sup>

(PL. 95, B, C.; 104, D)

*Aedemoses hesitans* Walsingham, 1912, in Biol. Centr.-Amer., Lep. Heter., v. 4, p. 154.

Eighteen specimens (males and females) of a moth which Mr. Busck has determined as this species were reared by Diven from larvæ which he had collected on "Mexican ebony" (*Siderocarpus flexicaulis*) at Brownsville, Tex. The genus and species were described by Walsingham from a unique female without hind legs, collected at Presidio Durango, Mexico, and have not since been recorded. The present rearing, therefore, adds another to our list of United States species. There can be no doubt of the identification, as Busck has seen and is familiar with the Walsingham type and our reared examples agree in all details with the description.

The larva is a leaf-tier, binding together several leaves and feeding within the tie, eating first the epidermis and later all but the veins of the leaves. It pupates within the tie, the pupa being naked and attached at its caudal end by a strand of silk to one of the leaves.

The larva is a typical stenomid, slightly flattened and with seta III antero-dorsad of and close to the spiracle on abdominal segments 1 to 7 (Pl. 104, D); body white with four pale purplish brown longitudinal stripes, one subdorsal pair just below the level of setæ I and II, and a dorso-lateral one just above the level of setæ III; thoracic and anal shields pale yellow; thoracic legs pale yellow, lightly shaded with brown;

<sup>1</sup> Meyrick sunk the genus *Aedemoses* Walsingham as a synonym of the genus *Stenoma* Zeller, but on insufficient grounds, as he disregards its very distinct venational structure in favor of general appearances. (MEYRICK, E. EXOTIC MICROLEPIDOPTERA, v. 1, pt. 13, p. 412. 1915.)

body tubercles inconspicuous, chitinized areas about them unpigmented except around setæ II<sup>a</sup> and II<sup>b</sup> on mesothorax and metathorax where they are pale brown; body hairs whitish yellow, rather long; abdominal crochets yellow, 40 to 44, unevenly biordinal and in a complete circle; anal fork absent; head pale yellow, the more heavily chitinized parts of trophi lighter brown; ocellar pigment black, continuous under the ocelli; length, full grown, 7 to 7.5 mm.

The pupa is the typical short, squatty stenomid form; smooth, without armature or processes of any kind except the very short, inconspicuous primary setæ and a pair of minute spines on the anal rise; seta III on abdominal segments well forward of the spiracle; spiracles distinct and rather large, very slightly produced; wings, antennæ, and metathoracic legs extending to anterior margin of fifth abdominal segment; antero-ventral margins of fifth abdominal segment curved around the edge of the wing tips; labial palpi very small, not reaching to proximo-lateral angles of maxillæ; eighth, ninth, and tenth abdominal segments considerably reduced and sharply tapering; prothorax broad, nearly one-third the breadth of mesothorax; proleg scars distinct; length 4 to 4.5 mm; width 1.5 to 2 mm.

Immature larvæ were collected by Diven in late January, 1919, and feeding larvæ as late as April 1, 1919; from the latter, moths issued from April 17 to 26 of the same year.

The male genitalia of the moth are figured in Plate 95, B, C.

#### FAMILY BLASTOBASIDAE

##### ZENODOCHIUM CITRICOLELLA (CHAMBERS)

(PL. 98, A-C; 102; 104, C; 105, I)

*Blastobasis citricolella* Chambers, 1880, in Rept. U. S. Dept. Agr. 1879, p. 206-207.

*Blastobasis citriella* Chambers, 1880, in Rept. U. S. Dept. Agr. 1879, p. 245.

*Zenodochium citricolella* Dietz, 1910, in Trans. Amer. Ent. Soc., v. 36, p. 11-12.

Feeding in dry okra pods, in the seed pods of Hibiscus, and in old or diseased cotton bolls we often found associated with *Pyroderces rileyi* a dirty brownish larva with a glistening black head and thorax, spinning a thin web in the seed pods within which it fed and pupated. A number were collected at various places in Chambers County (Smith Point, Point Bolivar, and South Bayou) and from these were reared a number of adults agreeing in genitalic and other characters with authentic reared specimens of *Zenodochium citricolella* Chambers in the United States National Museum. The species is a scavenger and probably a very general feeder, as it was originally recorded from dried oranges and is to be found in almost any dry or diseased malvaceous seed pod.

Figures of the male genitalia of the moth are given in Plate 98, A-C.

The larva is easily distinguished from *Pyroderces rileyi* and the other lepidopterous cotton feeders by the structural characters shown on Plates 102, 104, and 105. The most striking features are the oval chitinized plate on the submentum, the nearly complete fuscous circle surrounding the chitinization of tubercle III on abdominal segments 1 to 7, and the typical blastobasid arrangement of the prothoracic legs (Pl. 105, I), set very close together with the coxal lobes touching each other.

The species probably has several generations a year. Larvæ collected in August, 1918, produced moths in that month and throughout September. Others collected during November and December produced moths the following April.

#### HOLCOCERA OCHROCEPHALA DIETZ

(PL. 98, D-F)

*Holcocera ochrocephala* Dietz, 1910, in Trans. Amer. Entomol. Soc., v. 36, p. 31-32.

A large series of moths were reared during February and March, 1919, from larvæ collected December, 1918, in imperfectly opened and weevil-infested cotton bolls at Brownsville, Tex. They agree with the description and the single female paratype of Dietz's species in the United States National Museum, and I have no hesitation in so determining them. The larval habits are the same as those of *Zenodochium citricolella*. There probably has been some confusing of our material, as all the larvæ we have associated with the *H. ochrocephala* adults are identical with those of *Z. citricolella*. Probably, since the two species work together in the same way and are superficially alike, the larvæ of one species was preserved and that of the other reared. It is extremely unlikely that there should be two blastobasids in different genera without a single structural difference in their larvæ.

The male genitalia of the moth are figured in Plate 98, D-F.

#### HOLCOCERA CONFAMULELLA, N. SP.

(PL. 99, C)

##### **Holcocera confamulella**, n. sp.

Antennæ deeply excised above basal joint and with truncate scale tuft; very weakly ciliate. Palpi grayish ochreous, dusted with fuscous on outer sides. Face grayish ochreous, vertically banded with fuscous. Head and thorax grayish white mixed and suffused with fuscous scales. Forewings grayish white, suffused and mottled with fuscous, the fuscous scaling giving the outer two-thirds of the wing a distinctly gray-brown appearance, darkening into an ill-defined, outwardly angulate antemedial fascia bordering a grayish basal patch and forming an irregular, broken, and obscure vertical fascia beyond the middle; along the termen a few barely distinguishable fuscous spots; cilia grayish white. Hindwings very narrow, pale smoky fuscous; cilia paler, tinged with ochreous. Legs whitish ochreous on inner sides; the outer sides fuscous, spotted with white on tibiae and ringed with white or whitish ochreous at ends of joints. Male genitalia of type figured (Pl. 99, C). Alar expanse 14 to 15 mm.

HABITAT.—Brownsville, Tex. (More, Barber, Heinrich).

FOOD PLANT.—Fruits of *Crataegus*.

TYPE.—Cat. No. 23742, United States National Museum.

This species is very close to *Holcocera modestella* Clemens, to which it would run in Dietz's tables.<sup>1</sup> It may eventually prove to be that species, but in the absence of an authentic male of *H. modestella* from the type locality it is better to risk a possible synonym than to make a doubtful determination. I have seen no specimens of Clemens's species. The male genitalia here figured fix the concept of *H. confamulella* and enable its ready identification.

Five moths (male type and four male and female paratypes) were reared April 10 to 21, 1919, from fruits of *Crataegus* rather heavily infested by larvæ of *Crocidosema plebeiana* Zeller. The larvæ of *Holcocera confamulella* were not noted.

#### FAMILY ETHMIIDAE

##### ETHMIA DELLIELLA (FERNALD)

*Psecadia delliella* Fernald, 1891, in *Canad. Ent.*, v. 23, p. 29.

*Babaiaxa delliella* Busck, 1903, in *Dyar, List North Amer. Lep.*, no. 5935.

*Ethmia delliella* Barnes and McDunnough, 1917, *Check List Lep. Bor. Amer.*, no. 6645.

One moth reared April 30, 1919, from *Wissadula lozani* heavily infested by a stem-boring aegeriid (*Zenodoxus palmi* Neumoegen). Material collected at Brownsville, Tex., by E. L. Diven, March 28, 1919. Larva and habits not noted.

##### ETHMIA BITTENELLA (BUSCK)

*Tamarrha bittenella* Busck, 1906, in *Proc. U. S. Nat. Mus.*, v. 30, p. 730.

*Ethmia bittenella* Meyrick, 1914, *Lep. Cat.*, pars. 19, p. 28.

Two pupæ collected by Diven in galleries in stems of *Wissadula lozani*, Brownsville, Tex., April 1, 1919. Moth issued April 9, 1919.

The larvæ were not noted. The caterpillars of this family are, however, to be distinguished from the others having three setæ on the prespiracular shield of prothorax and IV and V of abdomen approximate by the presence of one or more secondary hairs on the body, usually on the abdominal segments in the region of the prolegs. The prolegs themselves are long and slender as in the Pterophoridae. On abdominal segment 9, seta I is higher than II.

<sup>1</sup> DIETZ, WM. G. REVISION OF THE BLASTOBASIDAE OF NORTH AMERICA. In *Trans. Amer. Ent. Soc.*, v. 36, no. 1, p. 24-33. 1910.

## FAMILY COSMOPTERYGIDAE

## PYRODERCES RILEYI (WALSINGHAM)

(PL. 102, A, B; 103, C; 105, D; 106, C; 107, E, F)

*Batrachedra rileyi* Walsingham, 1882, in Trans. Amer. Ent. Soc., v. 10, p. 198-199.*Batrachetra rileyi* Dyar, 1903, List North Amer. Lep., no. 6059.*Pyroderces rileyi* Busck, 1917, in Jour. Agr. Res., v. 9, no. 10, p. 362-366, 370.

The larva of this common scavenger is frequently mistaken for the pink bollworm. It is, however, very readily distinguished from it and similar pink-banded larvæ of the gelechioid and other groups.

Since a complete description of adult, larva, and pupa is given in Busck's article on the pink bollworm,<sup>1</sup> it will suffice here to call attention to the diagnostic characters of the immature stages.

For the larva these are:

Three setæ (III, IV, and V) triangularly grouped on prespiracular shield of prothorax; prothoracic II<sup>a</sup> higher than I<sup>a</sup>; IV and V on proleg-bearing abdominal segments approximate; III on eighth abdominal segment *anterior to the spiracle*; paired dorsal setæ (II) on the ninth abdominal segment *not on a single chitination*, but closer together than paired I on eighth abdominal segment (Pl. 105, D); *I and III approximate on ninth abdominal segment* (as in the Olethreutidae); IV and V approximate, with VI well separated from them on ninth abdominal segment; crochets of prolegs uniordinal and in a complete circle; anal fork absent; pink bandings on anterior and posterior margins (not in the middle) of the segments.

The sum total of these characters is possessed by no other caterpillar to be found on cotton.

The pupa (Pl. 107, E, F) may be distinguished by the following characters:

Pointed wing cases reaching to posterior margin of the sixth abdominal segment; antennæ reaching to tips of wings; maxillary palpi small and not reaching proximo-lateral angles of maxillae; vertex wider than prothorax; abdomen tapering, bluntly rounded, smooth except for primary hairs and a cluster of strong hooked setæ at posterior end and around anal opening; cremaster absent; no labial palpi or exposed metathoracic legs.

The drawings (Pl. 102, 103, 105-107) show the distinguishing structural characters of larva and pupa. It will be noted that a correction has been made in Busck's figure of the setal map of the ninth abdominal segment of the larva which omitted one of the ventral setæ. The setal arrangement of the ninth abdominal segment with all setæ in a row, I approximate to III and VI well-separated from IV and V, can not be

<sup>1</sup> BUSCK, August. OP. CIT. 1917, p. 362-366.

considered a family character. It serves, however, to separate *Pyroderces rileyi* from the gelechioid forms which it otherwise resembles.

# FAMILY TORTRICIDAE

## PLATYNOTA ROSTRANA (WALKER)

(Pl. 104, A; 105, A)

*Teras rostrana* Walker, 1863, in List Lep. Brit. Mus., pt. 28, p. 290.

*Platynota rostrana* Dyar, 1903, List North Amer. Lep., no. 5383.

This species and the following two are rather general feeders and are frequently found on cotton and other Malvaceae. We have reared moths of *Platynota rostrana* from cotton, okra (*Hibiscus esculentus*), *Malvaviscus drummondii*, *Bastardia viscosa*, *Amaranthus* spp., and *Cassia tora*, collected at Brownsville and several localities in Chambers County. The species is normally a leaf-feeder, tying the terminal leaves and pupating within the tie. We have, however, also found it occasionally feeding on the flower buds of okra and on one occasion (Dec. 31, 1918) Diven took three larvæ at Brownsville in dry cotton bolls, feeding on the lint. They pupated in the loose lint, and moths issued February 7 and March 3, 1919. In the Chambers County localities larvæ were collected during late August and early September, 1918, which produced moths late in September and early in October of the same year. There are at least two and probably three or more generations a year in Texas.

The larva is not likely to be confused with the pink bollworm. It is easily separable on the setal characters figured on Plates 104 and 105. The arrangement of the pared dorsal setæ (II) on the ninth abdominal segment (that is, on a single chitinization and considerably closer together than any dorsal pair on the eighth abdominal segment) (Pl. 105, A), coupled with the normal micro characters of three setæ on the pre-spiracular shield of prothorax, and a close approximation of IV and V on the proleg-bearing abdominal segments, distinguishes the families of the Tortricioidea. In Tortricidae proper (to which this and the two following species belong) seta I on the ninth abdominal segment is much as in the Gelechiidae (that is, rather well separated from III and often as near to II as to III) (Pl. 105, A). In the families Olethreutidae and Phaloniidae, on the other hand, I and III are approximate and very often on the same chitinization.

The pupa is typically tortricoid, with wings short and broad at the tip (not tapering) and having the abdominal segments armed dorsally with a double row of strong spines, those of the anterior rows larger and somewhat hooked (compare Pl. 108, D). It is distinguished from that of the common olethreutid malvaceous feeder (*Crocidosema plebeiana* Zell.) by the presence of a well-developed, bluntly rounded cremaster entirely lacking in the latter.

## PLATYNOTA FLAVEDANA CLEMENS

*Platynota flavedana* Clemens, 1861, in Proc. Acad. Nat. Sci. Phila., 1860, p. 348.

*Platynota flavedana* Dyar, 1903, List North Amer. Lep., no. 5382.

One specimen reared by Diven (May 23, 1919) from cotton leaves collected at Brownsville, Tex., May 7, 1919.

The larva was not noted.

The pupa is strikingly like that of *Platynota rostrana* Walker.

## AMORBIA EMIGRATELLA BUSCK

(PL. 109, F)

*Amorbia emigratella* Busck, 1910, in Proc. Ent. Soc. Washington, v. 11, p. 201-202.

*Amorbia emigratella* Walsingham, 1913, in Biol. Centr.-Amer., Lep. Heter., v. 4, p. 219.

Two moths reared from cotton May 19 and 24, 1919 (E. L. Diven) in same material infested by *Platynota flavedana*, collected at Brownsville, Tex., May 7, 1919. The pupa has a conspicuous mid-dorsal, cuplike, circular invagination near the anterior margins of the first seven abdominal segments, the anterior dorsal margins themselves being strongly chitinized and folded back into a projecting ridge; otherwise as in *P. rostrana*.

The larva was not noted.

## FAMILY OLETHREUTIDAE

## CROCIDOSEMA PLEBEIANA ZELLER

(PL. 99, A; 102, C, D; 103, E; 105, G; 106, B; 108, A-D)

*Crocidosema plebeiana* Zeller, 1847, in Isis von Oken, 1847, Heft 10, p. 721-722.

*Eucosma plebeiana* Walsingham, 1914, in Biol. Centr.-Amer., Lep. Heter., v. 4, p. 231-232.

Up to the present this almost cosmopolitan insect had not been recorded from the United States. Our collecting, however, showed it well distributed and fairly abundant in Texas. In the United States National Museum there are also several adults from California, so that its known range may be said to correspond roughly with the distribution of the Malvaceae. Adults were reared by us from the following plants: *Malvastrum spicatum* (Brownsville, Tex., May, 1919); hollyhock (*Althaea rosea*) (Brownsville, Tex., May, 1919); *Malvaviscus drummondii* (Smith Point, Tex., November, December, 1918; Anahuac, Tex., September, 1918); okra (*Hibiscus esculentus*) (Double Bayou, Tex., November, December, 1918); and *Kosteleyzkya* spp. (Anahuac, Tex., November, 1918). Larvæ were also collected in seed pods of *H. militaris* (Lake Charlotte, Tex., September, 1918) and in flowers of *H. rosa-sinensis* (Smith Point, Tex., November, 1918). They feed chiefly in the seed pods and on the seeds of



the plants infested, but occasionally also on the pollen of the flowers. The species is of special interest because its work and habits are almost identical with those of the genus *Pectinophora* and also because the larva is frequently pinkish and often has the outer crochets of the prolegs weakly developed or absent. It is easily mistaken for a half-grown pink bollworm. It is readily distinguished, however, by the structural characters here figured (Pl. 102, 103, 105, 106). The linear arrangement of setæ III, IV, and V on the prothorax, the position of III *anterior* to the spiracle on the eighth abdominal segment, the well-developed anal fork (Pl. 105, G), and the olethreutid grouping of the setæ on the ninth abdominal segment (Pl. 103, E) separate it from all the larvæ treated in his paper.

The characters of the pupal abdomen are shown on Plate 108, A-D. *Eucosma discretivana* Heinrich and *E. helianthana* Riley exhibit similar structures, but as neither of these species attacks Malvaceae there is little or no likelihood of confusing them with *Crocidosema*. We did not find *C. plebeiana* in cotton, but there appears to be no reason why it should not attack that plant; and its possible presence and confusion with the pink bollworm should be borne in mind in cotton inspection.

The male genitalia of the adult are shown in Plate 99, A.

#### EUCOSMA DISCRETIVANA, N. SP.

(Pl. 99, B)

##### *Eucosma discretivana*, n. sp.

Antennæ, palpi, face, and head dull, somewhat ashy fuscous. Thorax pale, dull fuscous; tegulæ fuscous with a very slight bronzy tint. Forewings dirty grayish white marked with grayish fuscous; an outwardly angulate grayish fuscous basal patch slightly wider on costa than dorsum; a somewhat paler, semioval patch on dorsum before tornus and extending half way to costa; several narrow, obscure lines of fuscous scales extending outwardly from costa and faintly streaking the white areas; a similar faint line extending from dorsum through middle of white area bordering basal patch; entire termen narrowly margined by pale grayish fuscous; the whitish areas of the wing most pronounced just beyond basal patch and near tornus; cilia grayish; costal fold deeply appressed and reaching nearly to middle of wing. Hindwings dull, smoky fuscous, cilia grayish white with a dull fuscous band along their base. Abdomen grayish fuscous with silvery white scales along the sides and a few scattered silvery scales beneath. Legs fuscous, shading to dirty gray-white on inner sides. Male genitalia of type figured (Pl. 99, B). Alar expanse 13 to 16 mm.

HABITAT.—Sheldon, Tex. (A. C. Johnson).

FOOD PLANT.—“Wild myrtle.” Larva boring in the stem and forming a gall.

TYPE.—Cat. No. 23743, United States National Museum.

Described from male type and three male and five female paratypes reared by A. C. Johnson, April 10 to 23, 1919, from larvæ collected by him March 14, 1919.

It is very close to *Eucosma obfuscana* Riley, which it strikingly resembles. The two species are, however, readily distinguishable on both genitalia and slight but constant color differences. In *E. obfuscana* the face, head, thorax, and base of antennæ are inky blue-black, the dark

margin of termen of forewing pronounced and blue-black, extending from the apex only a little over one-half the length of the termen, the white scaling of the tornal area extending into the cilia of the anal angle which are also white. In *E. discretivana* there is none of the blue-black scaling so noticeable in *E. obfuscana*, and the entire termen is faintly dark margined. The cucullus of the harpes of the male genitalia is also more narrowly elongate in *E. obfuscana* than in *E. discretivana*.

The larva is in general structure very like *Crocidosema plebeiana*, except that setæ I, III, IV, and V on the ninth abdominal segment are about equally spaced and the anal fork is lacking. The body is cream-white without markings; chitinized areas about body tubercles not pigmented; hairs whitish yellow; thoracic and anal shields pale yellow, scarcely pigmented; head light brown; crochets brown, 28 to 30, uniordinal and in a complete circle; length, full-grown, 10 to 10.5 mm.

The pupa is similar to that of *Crocidosema plebeiana* but somewhat larger, 8.5 to 9 mm. long by 2.5 mm. wide.

The two species are easily distinguished by their food plants and larval habits.

#### EUCOSMA HELIANTHANA (RILEY)

*Semasia helianthana* Riley, 1881, in Trans. St. Louis Acad. Sci., v. 4, p. 319.

*Thiodia helianthana* Dyar, 1903, in List North Amer., Lep., no. 5186.

*Eucosma helianthana* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 7081.

We found a larva about the size of the pink bollworm and superficially resembling it feeding in the flower heads and on the seeds of the large garden sunflower. It was somewhat pinkish and had a pale kidney-shaped spot on the thoracic shield similar to that of *Pectinophora*. It had the characteristic olethreutid arrangement of setæ on the ninth abdominal segment and proved to be the caterpillar of *Eucosma helianthana* Riley, a species limited in food plant as far as I know to *Helianthus*. As the pink bollworm does not attack sunflower and *E. helianthana* does not attack cotton, there is no reason to confuse the two. The structural differences are also easily seen under a binocular or a strong hand lens.

The pupa is similar to that of *Crocidosema plebeiana* but larger, about the size of that of *Eucosma discretivana*.

Larvæ were collected at Dickinson, Tex., September 28, 1918, and pupæ also were found at Smith Point, August 30, 1918. From the latter a moth was reared September 3 of the same year.

#### LASPEYRESIA TRISTRIGANA (CLEMENS)

*Stigmonota tristrigana* Clemens, 1865, in Proc. Ent. Soc. Phila., v. 5, p. 133.

*Enarmonia tristrigana* Dyar, 1903, List North Amer. Lep., no. 5275.

*Laspeyresia tristrigana* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 7220.

On the prairie lands and along the fences adjoining fields that had been planted in cotton the previous year (1917) we frequently found a white

and pinkish larva feeding on the seeds of *Baptisia* spp. about the size and with much the general appearance of the pink bollworm. Except for the complete circle of crochets on the prolegs the superficial resemblance was rather striking. The structural characters are so obviously different as to prevent confusion by a careful observer. The arrangement of setæ on the ninth abdominal segment is typically olothreutid (Compare Pl. 103, E; 105, B), and the grouping of the head setæ is also quite different from that of the pink bollworm;  $A^1$ ,  $A^2$ ,  $A^3$ , and  $L^1$  lie in almost a straight line, and the puncture  $A^a$  is well back of (almost directly posterior to)  $A^2$  rather than between it and  $A^1$  as in *Pectinophora gossypiella*.

The larva is most like that of *Eucosma helianthana*, from which it differs in the size of the head, the color of the thoracic shield, and the position of epicranial puncture  $A^a$ . In *E. helianthana* the puncture ( $A^a$ ) lies to the side directly dorsad of seta  $A^2$ , between it and the adfrontal suture, the head is smaller in the full-grown larva, and the thoracic shield is brown with a more or less distinct hyaline kidney-shaped spot on the side. In *Laspeyresia tristrigana* the shield is of the general body color with a few small, irregular, scattered yellow spots. Neither species has an anal fork.

The pupa is similar to that of *Crociosema plebeiana*.

Several adults were reared during May, 1919, from larvæ collected in August, 1918 (Anahuac, Tex.) and in November, 1918 (El Vista, Tex.).

## FAMILY PHALONIIDAE

### PHALONIA CEPHALANTHANA, N. SP.

(Pl. 100, A)

#### *Phalonia cephalanthana*, n. sp.

Antennæ grayish black, palpi dull yellow, whitish above and on inner sides. Face whitish. Head yellow. Thorax mahogany-red. Forewings brownish overlaid with mahogany-red mixed with a few blackish scales, the red scaling unevenly distributed, forming an obscure but distinguishable outwardly angulate basal patch, a broad, vertical, somewhat irregular median fascia, and a moderately broad, outwardly oblique costal dash near apex, the latter extending from apical fifth of costa to below middle of termen; other areas of wing brown, more or less streaked with reddish or black scales; cilia mixed brown, red, and black. Hind-wings smoky gray; underside faintly mottled; cilia grayish white. Legs heavily dusted on outer sides with grayish black; ends of joints and inner sides yellowish white. In general appearance to the naked eye the insect is a rather pale wine-red, blotched with darker shading of the same color. Male genitalia of type figured (Pl. 100, A). Alar expanse 8 to 10 mm.

HABITAT.—Shores of Lake Charlotte, Chambers County, Tex. (Heinrich).

FOOD PLANT.—*Cephalanthus occidentalis*.

TYPE.—Cat. No. 23744, United States National Museum.

Described from male type and 16 male and female paratypes reared September 16 to 24, 1919, from larvæ collected September 10, 1918; a distinct and easily recognized species.

The larva feeds in the seed pods. It is a dirty white with the chitinized areas about the body tubercles conspicuous, moderately large, round or oval, and a dull smoky fuscous, the chitinizations becoming heavier and more extended toward the caudal end; on the eighth abdominal segment paired setæ I are on a single chitinization; also paired II; on the ninth abdominal segment paired II, I, and III are on a single shield; the setal arrangement of the ninth abdominal segment is similar to that of the Olethreutidae with I and III rather closely approximate; seta III on eighth abdominal segment directly anterior to the spiracle; anal shield brown; anal fork developed, 6-pronged; crochets of prolegs uniordinal and arranged in a complete circle, 36 to 40; skin finely granulate; thoracic legs pale; thoracic shield the color of body except for a shading of yellow along hind margins. Head yellow, shading to yellowish brown; ocellar pigment slight, continuous but not filling the ocellar area; setæ of anterior and lateral group ( $A^1$ ,  $A^2$ ,  $A^3$ , and  $L^1$ ) crowded well forward on head;  $A^1$ ,  $A^2$ , and  $A^3$  forming a slightly acute angle;  $L^1$  closely approximate to  $A^3$ . Full-grown larva 8 to 9 mm. long.

The pupa is similar to that of *Crociosema plebeiana* except that the caudal end is more rounded. There is no cremaster.

#### FAMILY AGERIIDAE

##### ZENODOXUS PALMII (NEUMOEGEN)

*Larunda palmii* Neumoegen, 1891, in Ent. News, v. 2, p. 108.

*Paranthrene palmii* Beutenmüller, 1901, in Mem. Amer. Mus. Nat. Hist., v. 1, pt. 6, p. 316.

*Paranthrene palmii* Dyar, 1903, List North Amer. Lep., no. 4260.

*Zenodoxus palmii* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 6735.

Several specimens of this species were reared during April and May, 1919, from larvæ collected at Brownsville, Tex., January 23 and February 3, 1919, by H. C. Hanson and E. L. Diven. The caterpillars bore in the stems of *Wissadula lozani* and are usually found well down in the stems at the base of the plants near the roots. The adults agreed very well with the description of *Zenodoxus palmii* Neum. I have since compared them with the type in the Brooklyn Institute and have little hesitation in determining them as that species, although they are a trifle small (alar expanse 17.5 to 21 mm.).

The larvæ of this family are not likely to be confused with those of the pink bollworm and are easily identified by the peculiar arrangement of the ocelli—that is, with ocelli I to IV grouped together forming a trapezoid and V and VI well separated from the other four—and the crochets of the prolegs. The latter are always uniordinal and in two transverse bands. The setæ on the ninth abdominal segment are much the same as in the Olethreutidae.

The pupæ have two rows of strong spines on the dorsum of several of the abdominal segments as in the Tortricidae, but the wings are narrow and pointed, the maxillary palpi are large and conspicuous, and the thoracic spiracle is normally well developed; thus they are distinguished readily enough from pupæ of the latter group.

#### FAMILY PTEROPHORIDÆ

##### *OEDEMATOPHORUS VENAPUNCTUS*, N. SP., BARNES AND LINDSEY<sup>1</sup>

During April and May, 1919, Mr. E. L. Diven reared eight specimens of a pterophorid moth from larvæ feeding on the leaves of a composite at Brownsville, Tex. These were referred to Mr. Lindsey, who determined them as *Oedematophorus venapunctus*, an unpublished species, which he and Dr. Barnes had recently described from collected material.

The species is not a malvaceous feeder and has no special interest here apart from the rearing record and the structural peculiarities of the larva and pupa which, while strikingly modified in this particular form, will serve, nevertheless, to exemplify the family.

The pterophorid larvæ have only two setæ on the prespiracular shield of the prothorax and setæ IV and V approximate on the proleg-bearing abdominal segments, as in the Pyralidae with which they are affiliated. They have, however, in distinction from the Pyralidae proper, long stem-like prolegs and a greater or less development of secondary setæ. The crochets are also peculiar, being uniordinal, few in number (6 to 8 in the genus *Oedematophorus*), and arranged in a quarter circle opening outwardly. In *O. venapunctus* the secondary hairs are confined to a row

<sup>1</sup> Inasmuch as the foregoing name was desired for this paper in advance of their proposed revision of the Pterophoridae Drs. Wm. Barnes and A. W. Lindsey have kindly furnished the following description:

*Oedematophorus venapunctus*, n. sp., Barnes and Lindsey.

Head whitish ochreous between the antennæ, elsewhere light brown. Antennæ and palpi pale brownish ochreous, almost white, the latter short, oblique or porrect. Thorax and legs of the same shade of pale brownish ochreous, the fore and middle legs tinged with brown inside. Abdomen similar both above and below, with a fine, brown, middorsal line.

Primaries concolorous with thorax, darker toward costa, especially in first lobe, though this shade is scarcely evident in some specimens. Just before and below the base of the cleft is a small blackish brown spot, isolated except in our darkest specimen, in which it is continued obliquely toward the costa by a faint dark shade. In the outer margin of the second lobe there are four short, dark dashes on the tips of the anal, cubital, and third median veins. These are very faint in some specimens. A similar but heavier spot occurs on the inner margin of the first lobe a short distance before its apex at the tip of the fifth radial. Two vague dots sometimes appear on the costal margin of this lobe, one just before the apex and the other almost opposite the one on the inner margin. Fringes concolorous, slightly darker toward the apex of the wing and with their bases slightly paler. Secondaries somewhat paler than primaries and with a more grayish tinge. Fringes concolorous with slightly paler bases.

Expanse 15 to 18 mm.

Described from the following series: Holotype male, Brownsville, Tex., March; paratype male, same locality; allotype and six paratypes females, San Benito, Tex., March and April. (Collection Barnes).

Paratype male, Brownsville, Tex., March, and paratype female, from San Benito, Tex., April, in United States National Museum, type Cat. no. 23495.

This species appears to be allied to *Oedematophorus paleaceus*, *O. stramineus*, *O. kellicottii*, and related species. It differs from the first two in the presence of the terminal dots and from the last two in that the dot in the disc of the primaries is not contiguous to the base of the cleft. The form of the male genitalia also differs from that of any related species known to us. We have been unable to place it as a described Mexican or Central American species.

of 5 to 8 in the area normally occupied by seta VI. The body tubercles are somewhat produced, especially on the prothorax and tenth abdominal segment, and the hairs themselves are swollen and bulbous. In addition to the setæ there are on all except the first thoracic and the last abdominal segments several fingerlike projections from the skin. On the abdomen these arise back of setæ I, II, III, IV, and V from the base of their tubercles and in the area back of the spiracle and seta group IV-V. The prothorax is somewhat produced dorsally, and the head is capable of retraction under the cover of this rooflike projection.

In the pupa the venter of the eighth, ninth, and tenth segments is deeply concave with the lateral edges fringed by rather short flexible setæ. The ventral edge of the tenth segment and the anterior margins of the concavity are also armed with clusters of slender, hooked hairs. The caudal end is sharply pointed, but there is no distinct cremaster.

The larva is an external feeder, and the pupal period is very short. Larvæ collected by Diven from April 7 to 14, 1919, produced moths as early as the nineteenth of the same month.

#### FAMILY PYRALIDÆ

#### SUBFAMILY THYRIDINÆ

#### MESKEA DYSPTERARIA GROTE

(PL. 101, E, F; 104, B; 109, A-E)

*Meskea dyspteraria* Grote, 1877, in *Canad. Ent.*, v. 9, p. 115.

*Meskea dyspteraria* Dyar, 1903, *List North Amer. Lep.*, no. 4139.

This species was described by Grote from a single female collected in Bastrop County, Tex. Up to the present it has been rare in collections, Grote's type and a male from the Riley collection being the only representatives in the United States National Museum. Nothing was known of its larval habits or life history. We succeeded in rearing a large series of the moths and found their larvæ rather abundant though locally distributed. The larvæ mine the stems of several malvaceous plants, forming a conspicuous, elongate gall. The species seems to favor *Malvaviscus* and *Abutilon*; but occasional larvæ were found in galls on *Kosteletzkya* sp. (Anahuac, Tex., Aug. 13-14, 1918, More and Diven, collectors). The species overwinters as larvæ in the gallery, pupating in the spring and producing moths during April and May. From larvæ collected in *Malvaviscus drummondii* at Wallisville, Tex., September 3, 1918 (Hanson, Diven, and Heinrich), October 28, 1918 (Hunter, Busck, and Johnson), and November 5, 1918 (Barber, More, and Heinrich) moths were reared during May 9 to 25, 1919; in *M. drummondii* taken along the San Jacinto River near Crosby, Tex. (Hanson), November 6, 1918, moths issued May 4 to 10, 1918. Larvæ taken in *Abutilon berlandieri*, at Brownsville, Tex., December 31, 1918, and in *A. incanum* at Barreta, Tex., January 5,

1919 (Hanson) pupated the latter part of March and produced moths from April 5 to May 22, 1919. Neither larva nor work were found in cotton or okra or on any of the various species of Hibiscus, though there appears to be no reason why these plants should escape.

The full-grown larva is somewhat larger than a mature pink bollworm (22–22.5 mm. long) and is easily distinguished from it by the pyralid arrangement of the body setæ (*two* setæ only on prespiracular shield of prothorax and IV and V approximate on proleg-bearing abdominal segments). The structural characters of larva and pupa are fully illustrated in Plates 101, 104, and 109. These and the larval habits will serve to identify the species and distinguish it readily from any other lepidopteron of similar food plant and habits.<sup>1</sup>

#### SUBFAMILY PYRAUSTINAE

##### NOCTUELIA RUFOFASCIALIS (STEPHENS)

*Ennychia rufofascialis* Stephens, 1834, Illus. Brit. Ent., Haust. v. 4, p. 33.

*Botys* (?) *thalialis* Walker, 1859, List Lep. Brit. Mus., pt. 18, p. 582.

*Noctuelia thalialis* Hampson, 1899, in Proc. Zool. Soc. London, pt. 1, p. 279, 1899.

*Noctuelia thalialis* Dyar, 1903, List North Amer. Lep., no. 4478.

*Noctuelia rufofascialis* Barnes and McDunnough, 1918, Contrib. Nat. Hist. Lep. North Amer., v. 4, no. 2, p. 167.

The larva of this species is a seed-feeder in pods of Abutilon, Wissadula, Malvastrum, Sida, and possibly other malvaceous or similar plants. It feeds in much the same way as the pink bollworm and pupates in a thin cocoon either in the empty seed pod or on the outside of the plant. Two larvæ were taken at Brownsville, Tex., April 11, 1919, by Diven feeding in the young terminal shoots of cotton. This habit, however, is unusual. When full-grown the larva is about the size of a full-fed pink bollworm and seems ridiculously large for the small seed pods within which it must accommodate itself. It is very strikingly and beautifully marked and very similar to the caterpillars of *Gelechia bosquella* Chambers and *Borkhausenia diveni*, elsewhere mentioned in this paper. It is readily distinguished from them by the pyraloid setal arrangement of the prothorax (two setæ only in the prespiracular group). The general body color is white with the thoracic segments and anterior half of the first abdominal segment a deep wine-red. The remaining abdominal segments are also partially encircled by a broad band of the same color. The head is light yellow, and the thoracic and anal shields are yellow or brownish, the legs smoky fuscous, and the crochets of the prolegs (7 to 10) *uniordinal and arranged in a circle broken outwardly* as in the pink bollworm—a very unusual structure in this subfamily.

<sup>1</sup> It should be noted that puncture A\* on the epicranium is somewhat differently located on different specimens, sometimes higher, sometimes lower, occasionally even lying between seta A<sup>3</sup> and L<sup>1</sup> and frequently differently placed on opposite sides of the same head. Body seta IV on abdominal segment 9 is also very often absent. When present it is always short and inconspicuous.

Adults were reared during May, 1919, from larvæ collected in pods of *Abutilon* and *Malvastrum* at Brownsville, Tex., December 27, 1918 (Hanson), and April 12, 1919 (Diven). Other larvæ were collected in seed pods of *Wissadula* and *Sida* at Brownsville, but no adults were reared. The species is not common and we found it only in the vicinity of Brownsville.

PACHYZANCLA BIPUNCTALIS (FABRICIUS)

*Phalaena bipunctalis* Fabricius, 1794, Ent. Syst., t. 3, pars 2, p. 232.

*Pachyzancla bipunctalis* Dyar, 1903, List North Amer. Lep., no. 4344.

Several moths of this species were reared September 14 to 18, 1918, from larvæ tying the terminal leaves and feeding on the seeds of the common pigweed (*Amaranthus hybridus*). Larvæ were collected at Turtle Bayou, Tex., September 4, 1918.

The caterpillars are typical *Pyraustinae* with the proleg crochets *triordinal* and arranged in a penellipse.

All the *Pyralidae* are distinguished by having *two setæ* on the prespiracular shield of the prothorax (IV and V) and IV and V approximate on the proleg-bearing abdominal segments (compare Pl. 103, B; 104, B). No other group possesses this combination.

GLYPHODES PYLOALIS WALKER

*Glyphodes pyloalis* Walker, 1859, List Lep. Brit. Mus., pt. 19, p. 973-974.

*Glyphodes pyloalis* Hampson, 1899, in Proc. Zool. Soc. London, 1898, pt. 4, p. 746.

On a private estate near Alto Loma, Tex., the writer found a number of pyralid larvæ tying and feeding on the leaves of a mulberry tree. A moth was reared from these which both Mr. Schaus and Dr. Dyar have determined as *Glyphodes pyloalis* Walker. This record is of interest because *G. pyloalis* Walker is a Chinese species which has not hitherto been recorded from the United States. Unfortunately as the single reared specimen is a female the genitalia could not be compared with those of oriental specimens.

The larvæ were collected September 27, 1918. All died during the winter except one which pupated about the middle of April, 1919. The moth issued April 19, 1919.

SUBFAMILY CRAMBINAE

DICYMOLOMIA JULIANALIS (WALKER)

(PL. 101, C, D; 103, B; 106, D; 108, E-H)

*Cataclysta (?) julianalis* Walker, 1859, List Lep. Brit. Mus., pt. 17, p. 438.

*Dicymolomia julianalis* Dyar, 1903, List N. Am. Lep., no. 4634.

The larva of this species is the caterpillar popularly known in the cotton areas of Texas as the "white worm" and is the one most easily and frequently confused with the pink bollworm. The two when full-grown are about the same size, and both have the crochets on the



prolegs arranged in a circle broken outwardly. *Dicymolomia julianalis* is also frequently found in cotton bolls. Its normal and favored food plant is cattail (*Typha* sp.) in the spike of which it feeds and undergoes its transformation. In some parts of Texas, however, we also found it commonly in old and diseased cotton bolls, feeding upon the lint and in some cases the cotton seeds. We did not, however, find it in any green or healthy bolls. Larvæ were collected in the region about Beaumont during November, 1918, and near Brownsville from December, 1918, until early April, 1919. Adults issued from the latter part of March until the middle of May. The species overwinters in the larval stage, the caterpillars remaining in the fallen and rotting bolls and pupating during February and early March.

While very similar in superficial appearance to the pink bollworm and easily mistaken for it by one not familiar with larval characters, the caterpillar of *Dicymolomia julianalis* is easily distinguished on structure. The position of the anterior puncture ( $A^a$ ) of epicranium back of seta  $A^2$  and the presence of *only two* setæ on the small shield anterior to the prothoracic spiracle at once separates it from *Pectinophora*.

The pupa is smooth except for the normal body seta and a half dozen slender hooked spines on the cremaster and is not likely to be mistaken for that of *Pectinophora gossypiella*.

The structural characters of both larva and pupa are fully figured in Plates 101, 103, 106, and 108.

#### . SUBFAMILY PHYCITINAE

##### MOODNA OSTRINELLA (CLEMENS)

(Pl. 104, E)

*Ephestia ostrinella* Clemens, 1861, in Proc. Acad. Sci. Phila., 1860, p. 206.

*Manhatta ostrinella* Hulst, 1903, in Dyar, List North Amer. Lep., no. 4886.

*Moodna ostrinella* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 5795.

The larva of this species is a scavenger feeding in diseased cotton bolls in company with and in much the same manner as *Dicymolomia julianalis*. It is a smaller caterpillar (8 to 9.5 mm. long) when full-grown. The heavy, ringlike chitinization about tubercles  $II^b$  of the mesothorax and III of the eighth abdominal segment (Pl. 104, E), which is so conspicuous a feature on this and the following larva (*Homoeosoma electellum*), is a character found upon most phycitine larvæ but nowhere else, so far as I know, outside of this subfamily.

The caterpillar of *Moodna ostrinella* is a nearly uniform dirty white; thoracic shield smoky fuscous divided on dorsum by a wide median whitish line; body tubercles dark brown; skin finely granulate; body hairs moderately long, pale yellowish; legs whitish, ringed with smoky fuscous; head pale yellowish brown; labrum and anterior margins of epicranium blackish brown; ocellar pigment a black spot under each

ocellus, not continuous; crochets evenly biordinal, alternating one long and one very short hook, 40 to 44.

Larvæ collected November 24, 1918, at Kountz, Tex. Moth issued April 7, 1919.

HOMOEOSOMA ELECTELLUM (HULST)

(PL. 100, B)

*Anerastia electella* Hulst, 1887, in *Entomologica Americana*, v. 3, p. 137-138.

*Homoeosoma electellum* Hulst, 1903, in Dyar, *List North Amer. Lep.*, no. 4865.

A large series of moths was reared April 23 to May 5, 1919, from larvæ collected at Brownsville, Tex., April 7, 1919, by E. L. Diven. The larvæ feed in the flower heads of a composite, making an untidy patch and eating the bloom, stem, and seeds. The species appeared to be very common.

The larva is pale smoky brown, longitudinally marked by two narrow white dorsal stripes and a similar lateral stripe; spiracles black, thoracic legs smoky fuscous; anal shield yellow, thoracic shield yellow, broadly margined laterally and posteriorly with black; head pale yellow, mottled with yellowish brown and with a broad lateral black band and a blackish shading toward anterior margins of epicranium; ocelli distinct; ocellar pigment absent or confused in the lateral black of epicranium; general structural characters as in *Moodna ostrinella*; width 6 to 7 mm.

The interesting and rather complicated genitalia of the male adult are figured in Plate 100, B.

SUBFAMILY CHRYSAUGINAE

CLYDONOPTERON TECOMAE RILEY

*Clydonopteron tecomae* Riley, 1880, in *Amer. Ent.*, v. 3, no. 12, p. 288.

*Salobrana tecomae* Dyar, 1903, *List North Amer. Lep.*, no. 4526.

*Clydonopteron tecomae* Barnes and McDunnough, 1917, *Check List Lep. Bor. Amer.*, no. 5283.

The larva of this species feeds only in the seed pods of the trumpet-flower vine (*Tecoma radicans*). It is mentioned here only because its host plant is often found in the neighborhood of the cotton fields and for that reason it might be confused by the uncritical with the larva of *Pectinophora gossypiella*. It is easily distinguished, however. The spiracles are rather large, oval, and black, the edges are heavily chitinized, and the spiracle on the eighth abdominal segment is somewhat larger but no higher on the body than the others; the proleg crochets are arranged as in the Aegeriidae—that is, uniordinal and in two transverse bands—and the prothorax has only two setæ on the chitinization before the spiracle as in other Pyralidae. It pupates in a cocoon within the seed pod.

Moths were reared by us August 30 to September 15, 1918, from larvæ collected earlier in August (Anahuac, Tex.) the same year.

FAMILY NOCTUIDAE

Several species of this family feed upon cotton and malvaceous plants. They are easily distinguished from the pink bollworm or larvæ of any of the other groups treated in this paper by the arrangement of the body setæ and the crochets of the prolegs. Like the *Pyralidae* they have only two setæ (IV and V) on the prespiracular shield of the prothorax, but the position of IV and V on the proleg-bearing segments is quite different, IV being *remote* from V and directly back of the spiracle (Pl. 103, D). The crochets of the prolegs are also arranged in a mesoseries (Pl. 106, E).

The following species were reared.

SUBFAMILY AGROTINAE

HELIOTHIS (CHLORIDEA) OBSOLETA (FABRICIUS)

(PL. 103, D; 106, E)

*Bombyx obsoleta* Fabricius, 1793, Ent. Syst., t. 3, pars. 1, p. 456.

*Heliothis armiger* Dyar, 1903, List North Amer. Lep., no. 2300.

*Chloridea obsoleta* Hampson, 1903, in Cat. Lep. Phal. Brit. Mus., v. 4, p. 45, 657.

*Heliothis obsoleta* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 1090.

This species is commonly known as the "corn earworm" or "cotton bollworm." It feeds on a number of plants and often attacks cotton, doing serious damage in some localities. The larva bores into the bolls, making a large hole and destroying lint and seeds.

One moth was reared from a larva feeding on the leaves of *Malvaviscus drummondii* at Brownsville, Tex. A larva was collected by E. L. Diven, May 7, 1919. The adult emerged May 29 of the same year.

HELIOTHIS (CHLORIDEA) VIRESCENS (FABRICIUS)

*Noctua virescens* Fabricius, 1781, Spec. Insect., t. 2, p. 216.

*Chloridea virescens* Dyar, 1903, List North Amer. Lep., no. 2296.

*Chloridea virescens* Hampson, 1903, in Cat. Lep. Phal. Brit. Mus., v. 4, p. 48.

*Heliothis virescens* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 1091.

This species has very much the same habits as *Heliothis obsoleta* Fabricius. Moths were reared September 8 and 17, 1919, from larvæ taken feeding on seeds in okra pods August 19, 1918, at Double Bayou, Tex. (E. L. Diven).

## SUBFAMILY ACRONYCTINAE

## BAGISARA RECTIFASCIA (GROTE)

*Schinia rectifascia* Grote, 1874, in Proc. Boston Soc. Nat. Hist., v. 16, 1873/74, p. 242.

*Atelhmia rectifascia* Dyar, 1903, List North Amer. Lep., no. 2267.

*Bagisara rectifascia* Hampson, 1910, in Cat. Lep. Phal. Brit. Mus., v. 9, p. 156.

One moth was reared September 1 and one September 23, 1918, from larvæ collected on *Malvaviscus drummondii* August 10, 1918 (Anahuac, Tex., J. D. More). Dr. Dyar, who determined the Noctuidae, informs me that the larva of this species has not been described. Unfortunately those preserved with the foregoing experiment are Catocalinae of some kind and probably have no connection with the adults reared.

## SUBFAMILY EREBINAE

## ALABAMA ARGILLACEA (HÜBNER)

*Aletia argillacea* Hübner, 1820, Zutr. Samml. Exot. Schmett., fig. 399.

*Alabama argillacea* Dyar, 1903, List North Amer. Lep., no. 2555.

Several moths were reared from larvæ feeding on the cotton leaves. Larvæ were taken September 25, 1918, at Dickinson, Tex., and moths early in October of the same year. The species pupates within the folded leaves on the plant.

## ANOMIS EXACTA HÜBNER

*Anomis exacta* Hübner, 1810, Samml. Exot. Schmett., v. 2, pl. 411.

*Anomis exacta* Dyar, 1903, List North Amer. Lep., no. 2557.

One moth was reared September 1, 1918, from a larva collected on *Malvaviscus drummondii*, Anahuac, Tex., August 14, 1918 (J. D. More). The larva pupated August 21, spinning a loose tie of several leaves.

## ANOMIS EROSA HÜBNER

*Anomis erosa* Hübner, 1818, Zutr. Samml. Exot. Schmett., fig. 287.

*Anomis erosa* Dyar, 1903, List North Amer. Lep., no. 2556.

One moth from Brownsville, Tex., January 19, 1919, was reared from a pupa in the tied leaves of *Abutilon incanum* (H. C. Hanson, collector).

## FAMILY LYCAENIDAE

## STRYMON MELINUS HÜBNER

*Strymon melinus* Hübner, 1818, Zutr. Exot. Schmett., fig. 121.

*Uranotes melinus* Dyar, 1903, List North Amer. Lep., no. 335.

*Strymon melinus* Barnes and McDunnough, 1917, Check List Lep. Bor. Amer., no. 352.

This caterpillar feeds on a great variety of plants, including practically all the Malvaceae. On cotton it attacks the flowers and bolls, boring into the latter and feeding upon lint and seeds and making, when half-

grown, a hole which reminds one very much of the exit hole made by a pink bollworm.

The larva itself looks nothing like any of the others here treated. It is spindle-shaped, sharply tapering at each end, broad in the middle in proportion to its length, with a small head, the body covered with fine stiff secondary hairs, and greenish yellow in color.

In addition to cotton we find it frequently on okra, *Kosteletzkya* spp., *Malvariscus drummondii*, and *Hibiscus* spp. On these it fed on the seeds, boring into the seed pods, or upon the blossoms.

The table of larval characters will serve to place the forms here treated. The characters given are not to be understood as diagnostic in all cases. In the Cosmopterygidae, for example, seta I is often as far from III as it is from II as in the Gelechiidae or the Oecophoridae. There are also a few exceptions to the gelechiid character (the remoteness of epicranial seta  $L^1$  from  $A^3$ ). The characters hold, however, for all the species here treated occurring on Malvaceae.

*Characters of larvæ likely to be confused with the pink bollworm*

1. Body depressed and spindle-shaped, covered with secondary setæ. . . . . LYCAENIDAE.  
Body otherwise. . . . . 2
2. Setae IV and V on proleg-bearing abdominal segments closely approximate. . . . . 3  
Setae IV and V on proleg-bearing abdominal segments well-separated. . . . . 13
3. Prespiracular shield of prothorax bearing two setæ only. . . . . 4  
Prespiracular shield of prothorax bearing three setæ. . . . . 5
4. Prolegs long and slender; body of larvæ normally with one or more secondary setæ. . . . . PTEROPHORIDAE.  
Prolegs otherwise; body with only primary setæ. . . . . PYRALIDAE.
5. Body with one or more secondary setæ. . . . . ETHMIDAE.  
Body with only primary setæ. . . . . 6
6. Ocelli I to IV grouped together, forming a trapezoid; ocelli V and VI fairly close together but well-separated from the other four. . . . . AGERIIDAE.  
Ocelli otherwise. . . . . 7
7. Paired dorsal setæ II on ninth abdominal segment closer together than paired I on dorsum of eighth abdominal segment; usually on a single chitinization. . . . . 8  
Paired dorsal setæ II on ninth abdominal segment at least as far apart as paired I on eighth abdominal segment and not on a single chitinization. . . . . 9
8. Setae I and III closely approximate on ninth abdominal segment. . . . . 10  
Setae I and III not closely approximate on ninth abdominal segment TORTRICIDAE.
9. Epicranial seta  $L^1$  remote from  $A^3$  (farther from  $A^3$  than  $A^3$  is from  $A^2$ ) GELECHIDAE.  
Epicranial seta  $L^1$  approximate to  $A^3$ , at least no farther from  $A^3$  than  $A^3$  is from  $A^2$ . . . . . 11
10. Seta  $II^a$  on prothorax higher than  $I^a$ . . . . . COSMOPTERYGIDAE.  
(in part: *Pyroderces rileyi*).  
Seta  $II^a$  on prothorax not higher than  $I^a$ . . . . . OLETHREUTIDAE.  
PHALONIIDAE.
11. Prothoracic legs very close together, coxæ touching. . . . . BLASTOBASIDAE.  
Prothoracic legs appreciably separated. . . . . 12

12. Setæ III on abdominal segments I to VII antero-dorsad of and close to the spiracle.....STENOMIDAE.  
Setæ III on abdominal segments I to VII dorsad of the spiracle; if occasionally somewhat antero-dorsad not close to the spiracle.....OECOPHORIDAE.
13. Seta IV directly behind the spiracle on proleg-bearing abdominal segments; crochets of prolegs arranged in a mesoseries; two setæ only on prespiracular shield of prothorax; no secondary hair on body or head.....NOCTUIDAE.  
(in part, as here represented).

PLATE 93

Male genitalia (Gelechiidae):

- A.—*Gelechia trophella*: Posterior part of tegumen, showing uncus and gnathos, ventral view.  
B.—*G. trophella*: Lateral view of male genitalia with eighth abdominal segment attached.  
C.—*G. hibiscella*: Lateral view of male genitalia with eighth abdominal segment attached.

Explanation of symbols applied to male genital organs on Plates 93-100.

Ae=aedoeagus (outer chitinous sheath of penis).

An=anellus (chitinous support of aedoeagus).

Ao=opening in tegumen through which anal tube passes.

Cl=clasper on harpe.

Cn=cornutus (cornuti) spine or spines on penis proper.

Cs=cucullus of harpe.

Gn=gnathos.

Hp=harpe.

Si=soci.

Tg=tegumen.

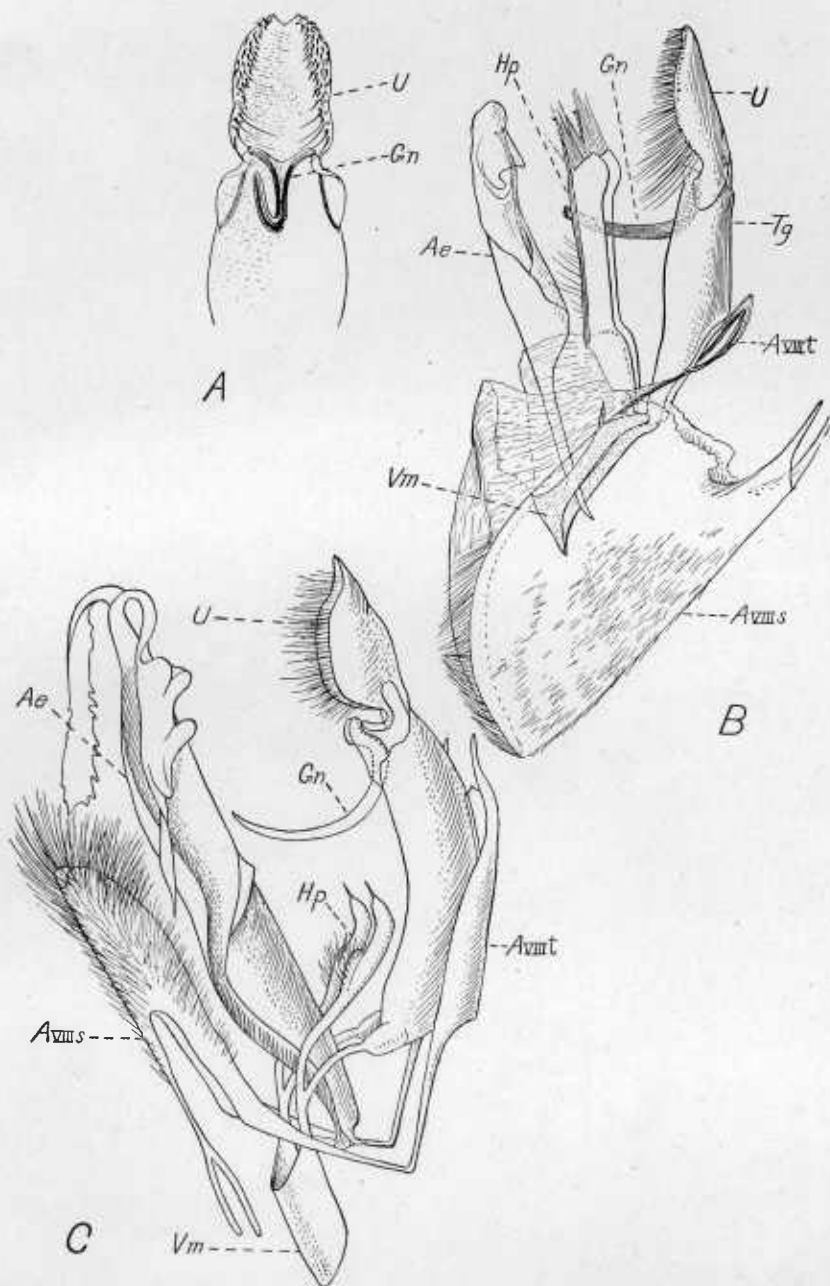
Ts=transtilla (a costal bridge, or sometimes elements thereof not united; connecting the harpes).

Vm=vinculum.

U=uncus.

A VIIIs=sternite of eighth abdominal segment.

A VIIIIt=tergite of eighth abdominal segment.





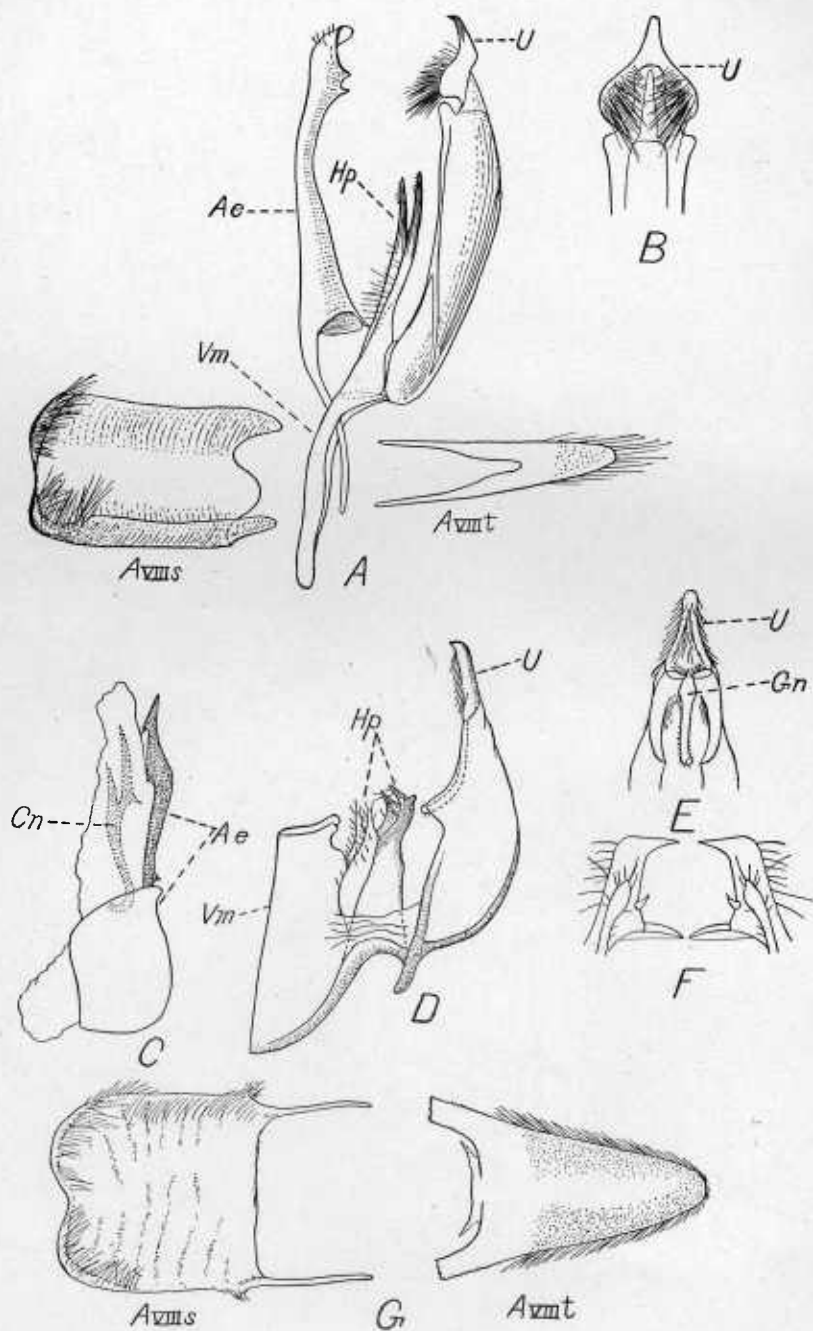


PLATE 94

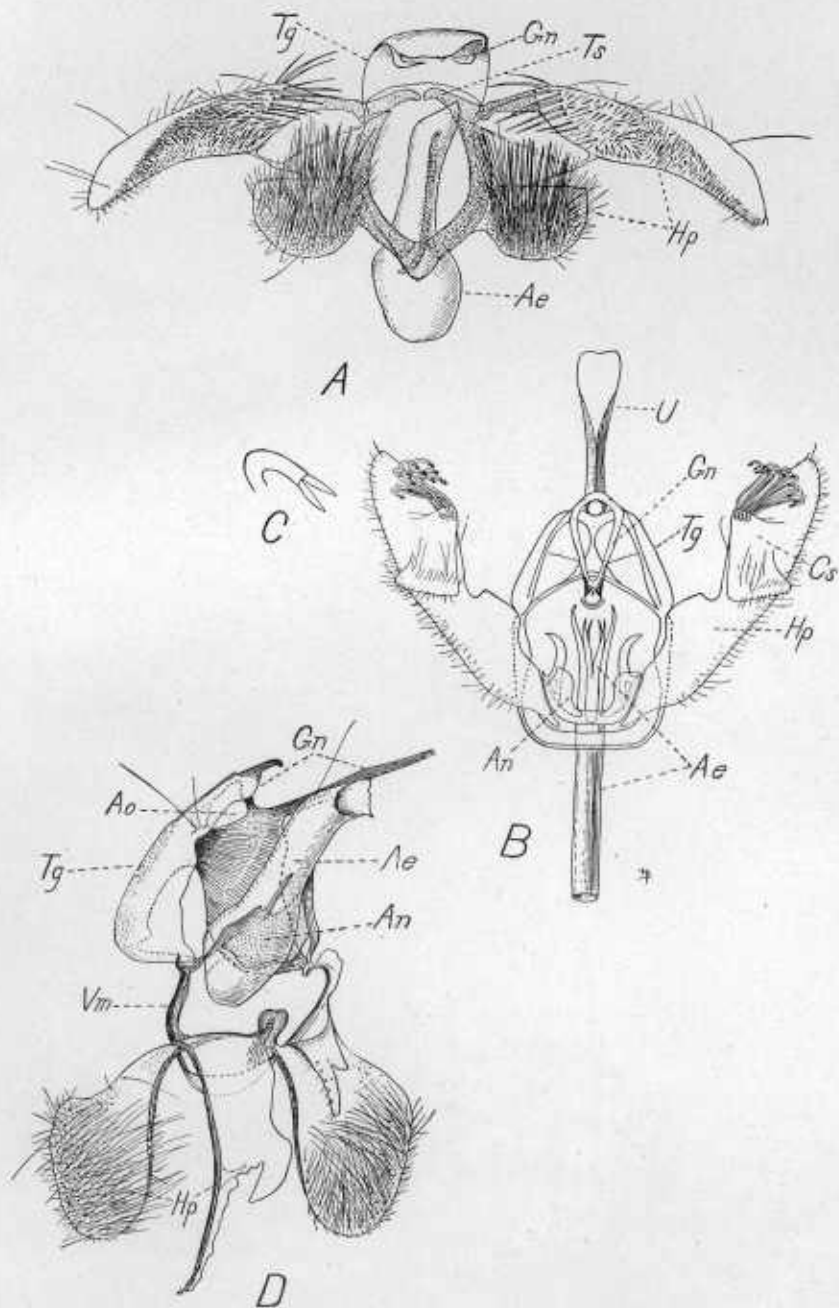
Male genitalia (Gelechiidae):

- A.—*Telphusa mariona* (type): Lateral view of male genitalia.
- B.—*T. mariona* (type): Posterior part of tegumen, showing uncus, ventral view.
- C.—*Gelechia neotrophella* (type): Aedoeagus and penis.
- D.—*G. neotrophella* (type): Lateral view of male genitalia with aedoeagus and eighth segment removed.
- E.—*G. neotrophella* (type): Posterior part of tegumen, showing uncus and gnathos, ventral view.
- F.—*G. neotrophella* (type): Posterior half of harpes, ventral view.
- G.—*G. neotrophella* (type): Sternite and tergite of modified eighth abdominal segment.

PLATE 95

Male genitalia (Gelechiidae, Stenomidae, and Oecophoridae):

- A.—*Isophrictis similiella*: Ventral view of male genitalia, spread.
- B.—*Aedemoses haesitans*: Ventral view of male genitalia, spread.
- C.—*A. haesitans*: Enlargement of typical split hair on cucullus.
- D.—*Borkhausenia fasciata*: Ventro-lateral view of male genitalia, spread, showing asymmetrical armlike projections from gnathos and costa of harpes.



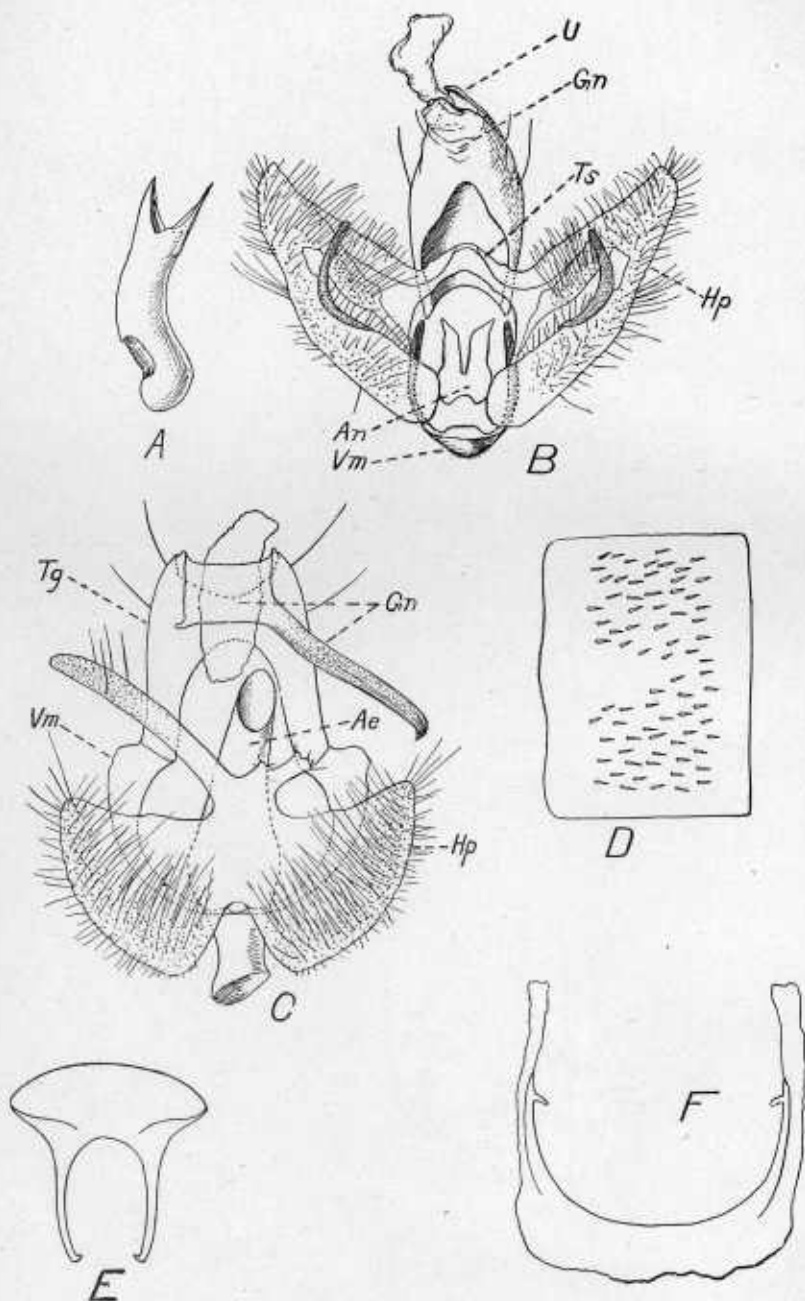


PLATE 96

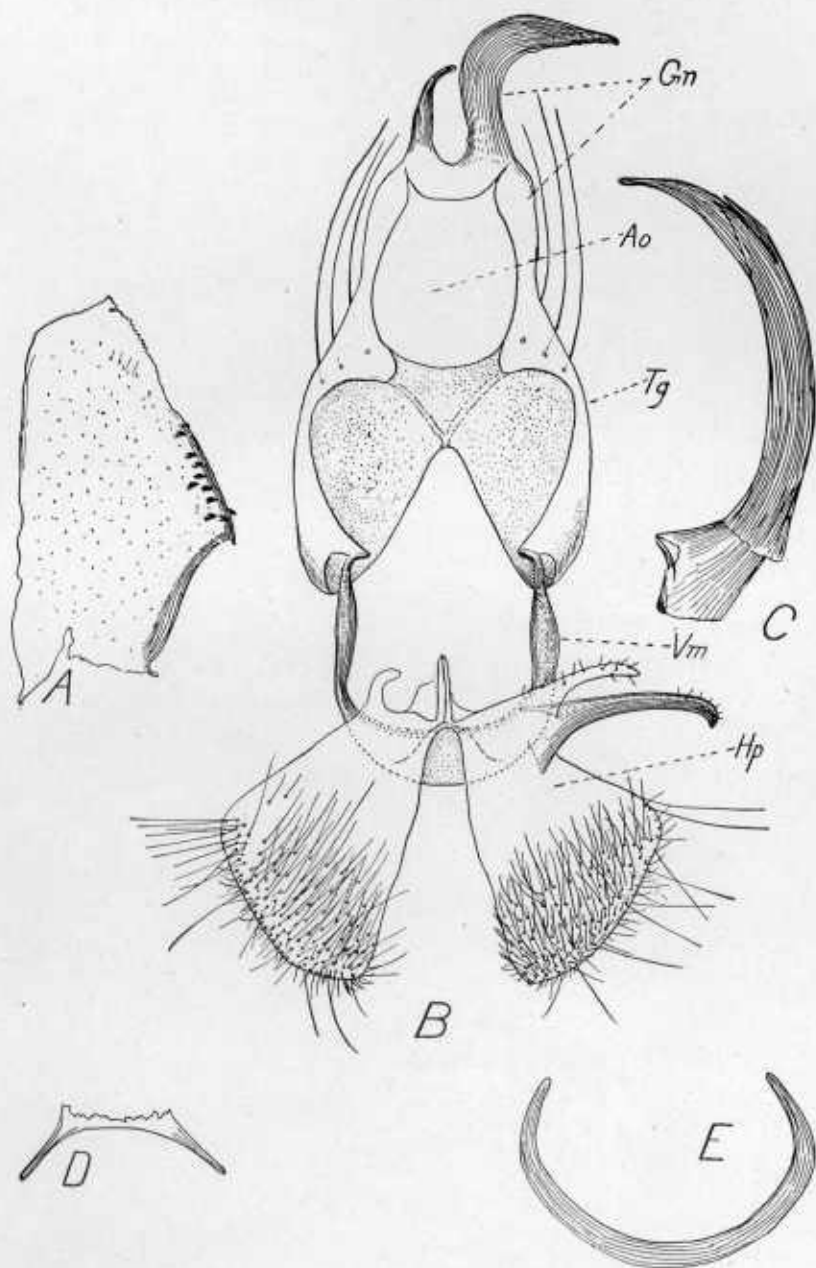
Male genitalia (Oecophoridae):

- A.—*Borkhausenia minutella*: Aedocagus.
- B.—*B. minutella*: Ventral view of male genitalia, spread, aedocagus omitted.
- C.—*B. diveni* (type): Ventral view of male genitalia, spread.
- D.—*B. diveni* (type): Dorsal view of an abdominal segment showing spinose condition of abdomen.
- E.—*B. diveni* (type): Modified tergite of eighth abdominal segment.
- F.—*B. diveni* (type): Modified sternite of eighth abdominal segment.

PLATE 97

Male genitalia (Oecophoridae):

- A.—*Borkhausenia conia*: Portion of tergite of seventh abdominal segment, showing spinose and chitinized character of caudal margin.
- B.—*B. conia*: Ventral view of male genitalia, spread, aedoeagus omitted.
- C.—*B. conia*: Aedoeagus.
- D.—*B. conia*: Modified tergite of eighth abdominal segment.
- E.—*B. conia*: Modified sternite of eighth abdominal segment.





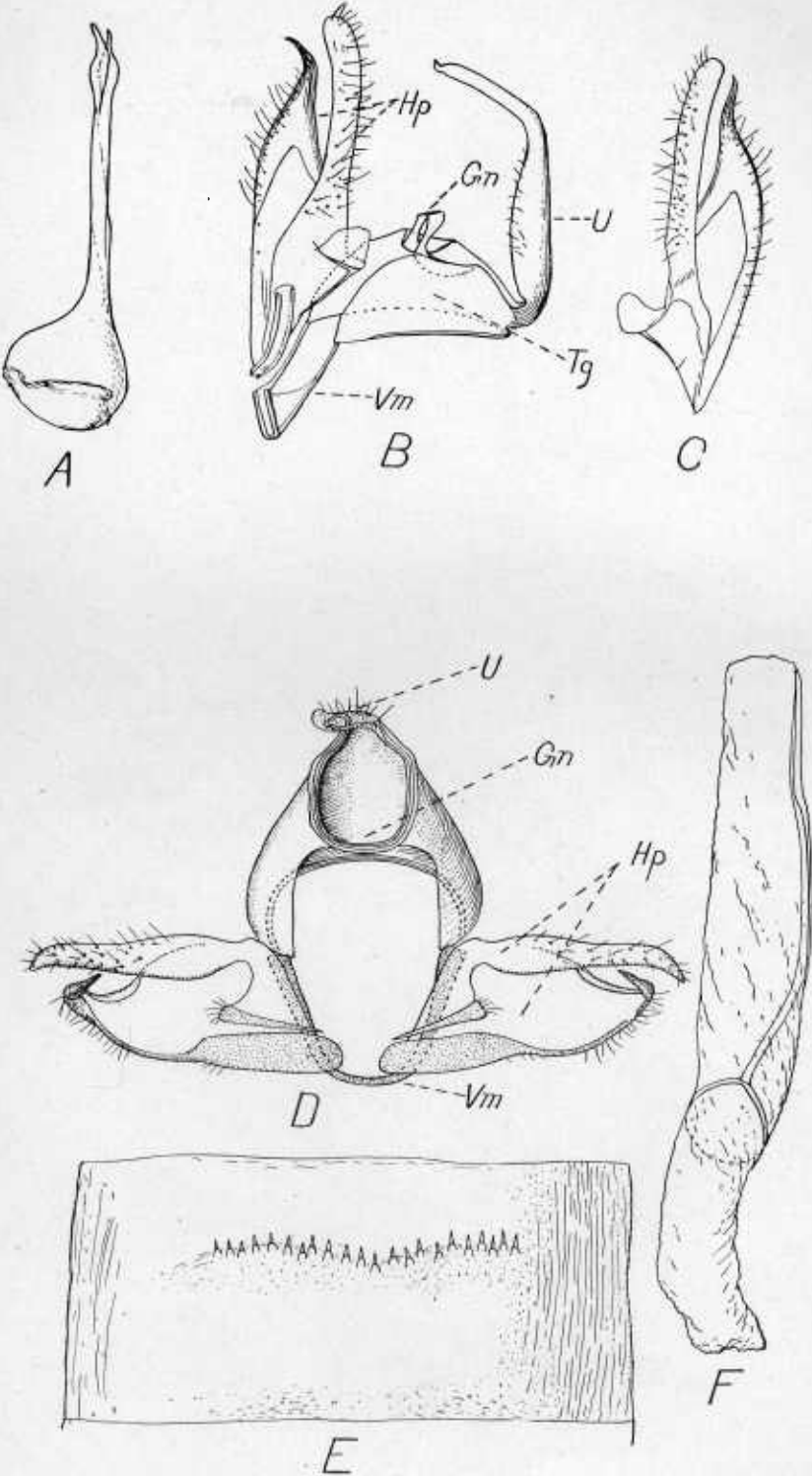


PLATE 98

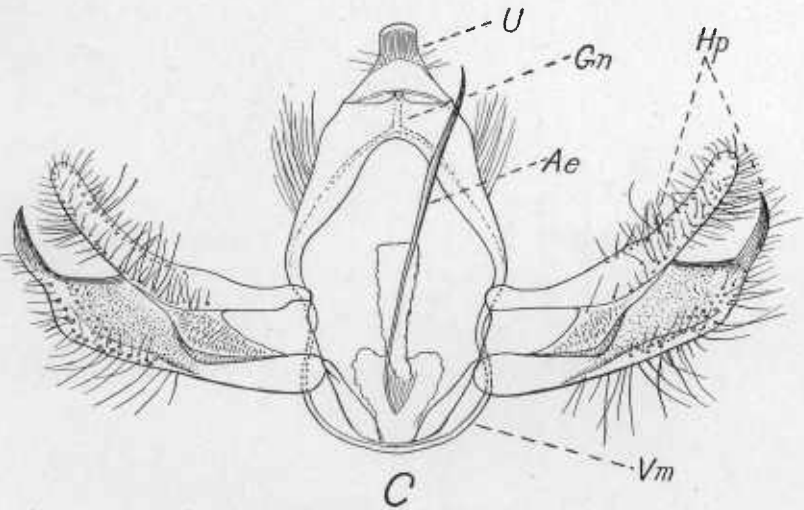
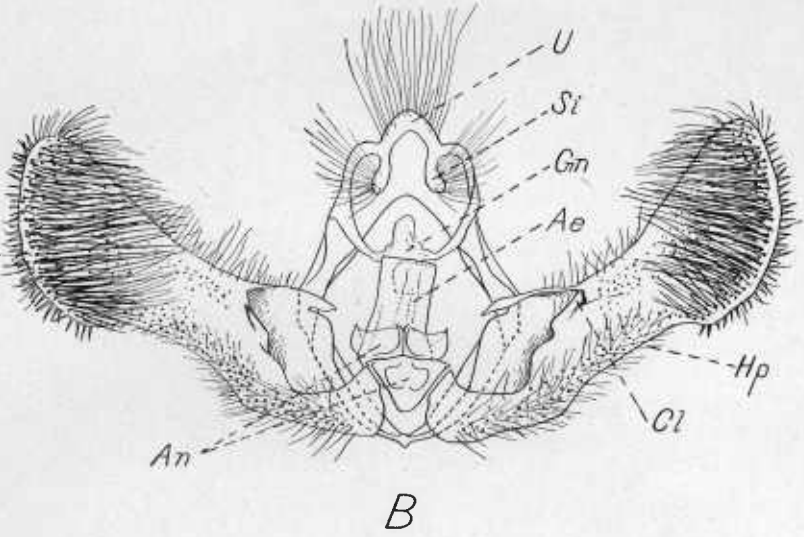
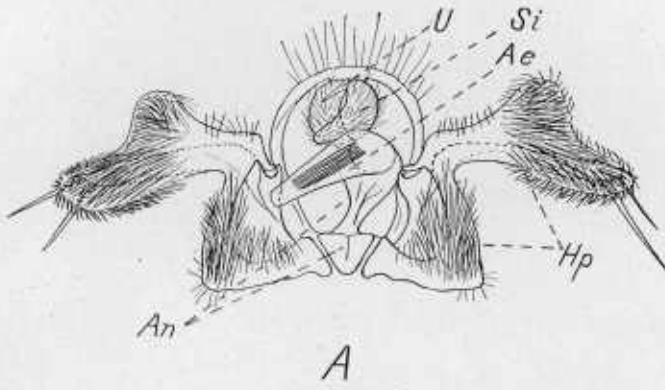
Male genitalia (Blastobasidae):

- A.—*Zenodochium citricolella*: Aedoeagus.  
B.—*Z. citricolella*: Lateral view of male genitalia, right harpe and aedoeagus omitted.  
C.—*Z. citricolella*: Right harpe.  
D.—*Holcocera ochrocephala*: Ventral view of male genitalia, spread, aedoeagus omitted.  
E.—*H. ochrocephala*: Dorsum of an abdominal segment showing transverse row of spines.  
F.—*H. ochrocephala*: Aedoeagus and penis.

PLATE 99

Male genitalia (Olethreutidae and Blastobasidae):

- A.—*Crociosema plebeiana*: Ventral view of male genitalia, spread.
- B.—*Eucosma discretivana* (type): Ventral view of male genitalia, spread.
- C.—*Holcocera confamulella* (type): Ventral view of male genitalia, spread.



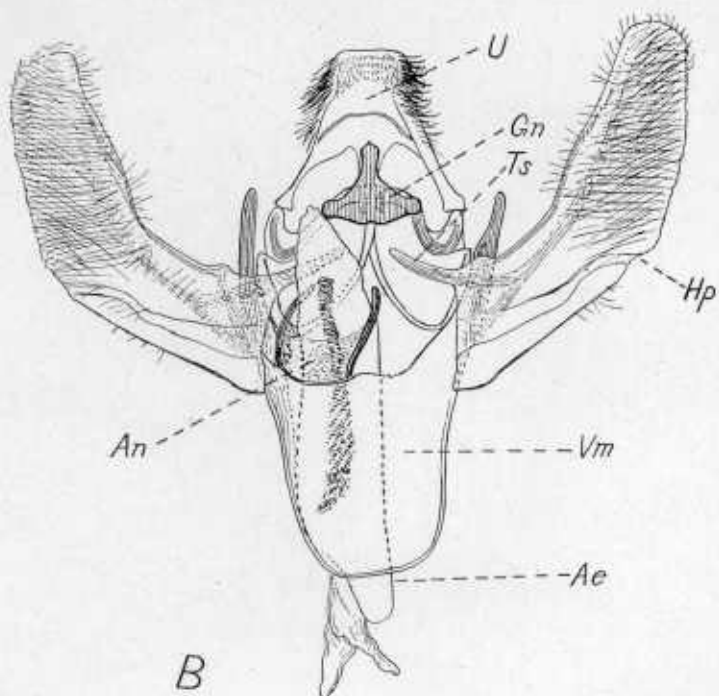
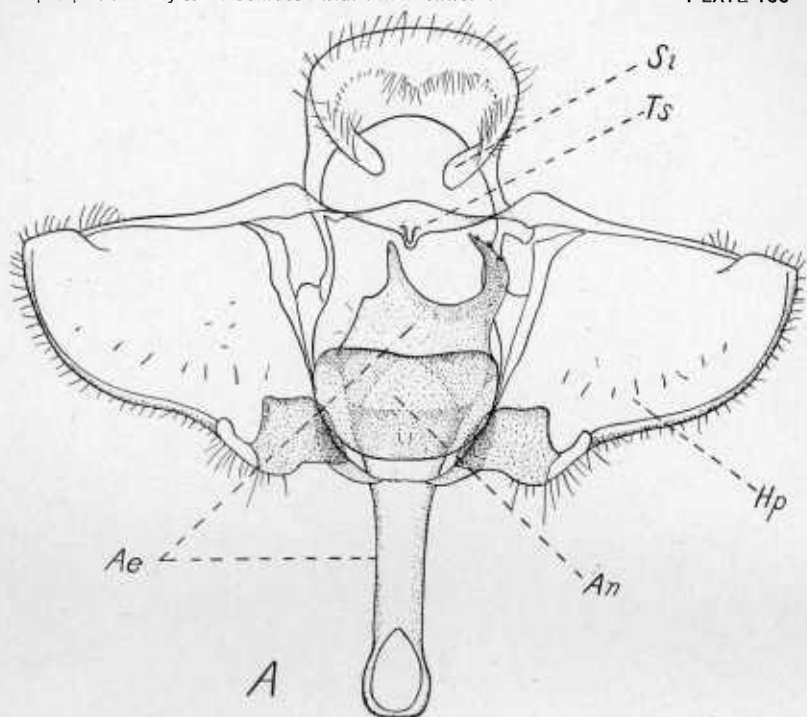


PLATE 100

Male genitalia (Phaloniidae and Pyralidae):

A.—*Phalonia cephalanthana* (type): Ventral view of male genitalia, spread.

B.—*Homoeosoma electellum*: Ventral view of male genitalia, spread.

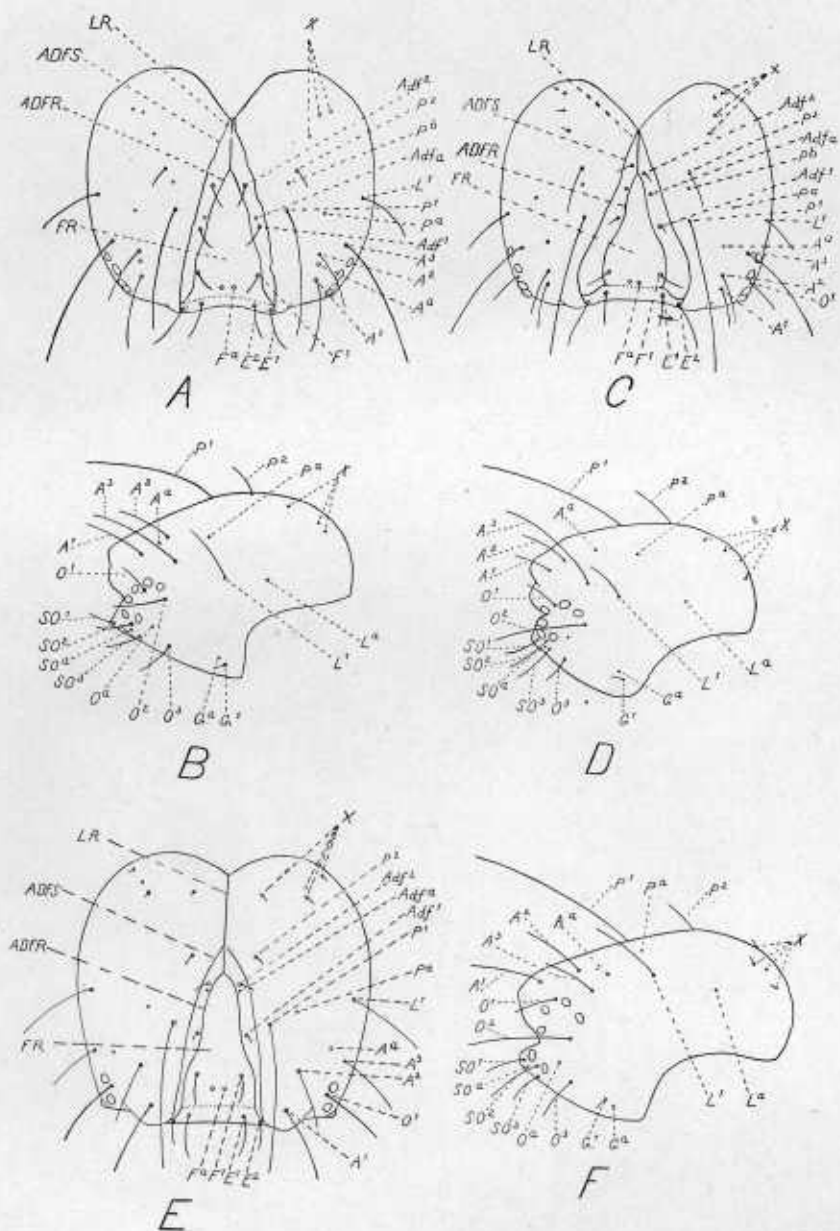
PLATE 101

Larval structures:

- A.—*Pectinophora gossypiella*: Head capsule, dorsal view, showing arrangement of setæ.  
B.—*P. gossypiella*: Head capsule, lateral view, showing arrangement of setæ.  
C.—*Dicymolomia julianalis*: Head capsule, dorsal view, showing arrangement of setæ.  
D.—*D. julianalis*: Head capsule, lateral view, showing arrangement of setæ.  
E.—*Meskea dyspteraria*: Head capsule, dorsal view, showing arrangement of setæ.  
F.—*M. dyspteraria*: Head capsule, lateral view, showing arrangement of setæ.

Explanation of symbols applied to larvæ on Plates 101-106.

- A<sup>1</sup>, A<sup>2</sup>, A<sup>3</sup>, A<sup>a</sup>=anterior setæ and puncture of epicranium.  
Adf<sup>1</sup>, Adf<sup>2</sup>, Adf<sup>a</sup>=adfrontal setæ and puncture of epicranium.  
ADFR=adfrontal ridge of frons.  
ADFS=adfrontal suture.  
AF=anal fork.  
E<sup>1</sup>, E<sup>2</sup>=epistomal setæ.  
F<sup>1</sup>, F<sup>a</sup>=frontal seta and puncture.  
FR=frons.  
G<sup>1</sup>, G<sup>a</sup>=genal seta and puncture of epicranium.  
L<sup>1</sup>, L<sup>a</sup>=lateral seta and puncture of epicranium.  
LR=longitudinal ridge of frons.  
O<sup>1</sup>, O<sup>2</sup>, O<sup>3</sup>, O<sup>a</sup>=ocellar setæ and puncture of epicranium.  
P<sup>1</sup>, P<sup>2</sup>, P<sup>a</sup>, P<sup>b</sup>=posterior setæ and punctures of epicranium.  
SMp=platelike chitinization on submentum.  
SO<sup>1</sup>, SO<sup>2</sup>, SO<sup>3</sup>, SO<sup>a</sup>=subocellar setæ and puncture of epicranium.  
X=Ultraposterior setæ and punctures of epicranium.





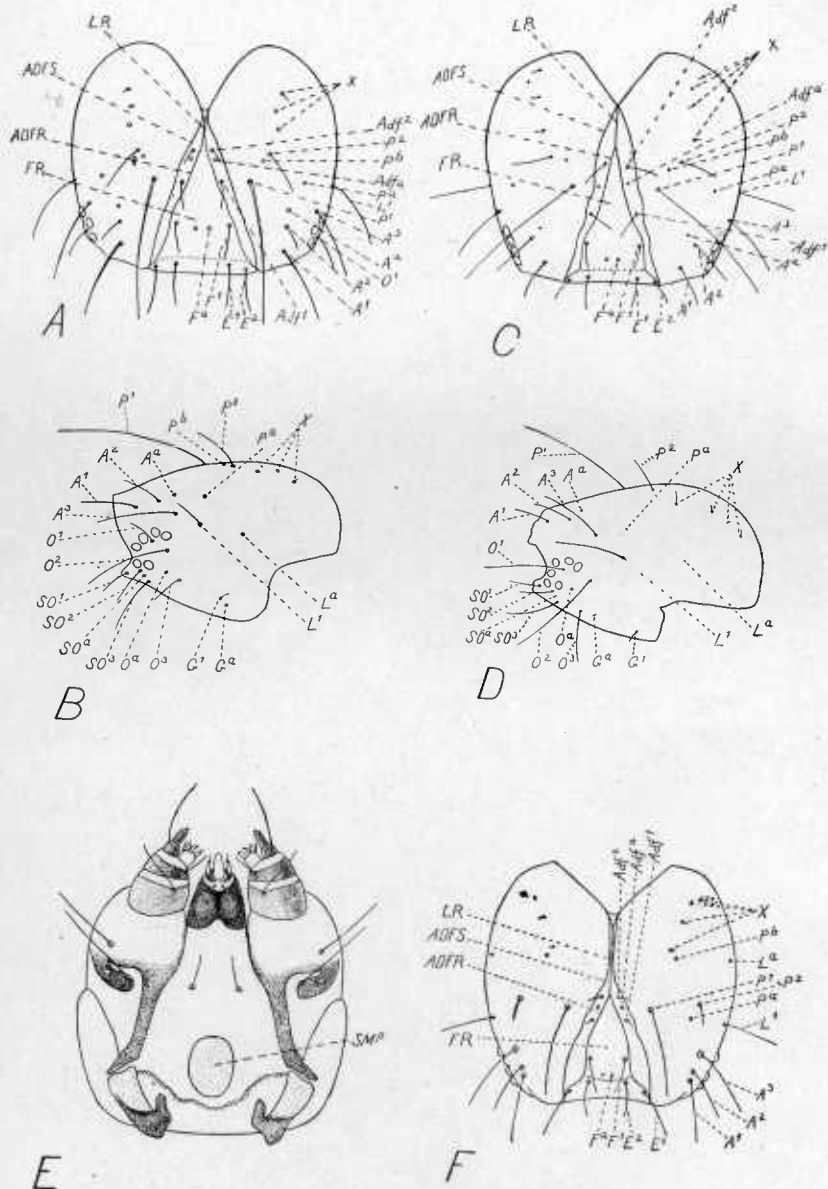


PLATE 102

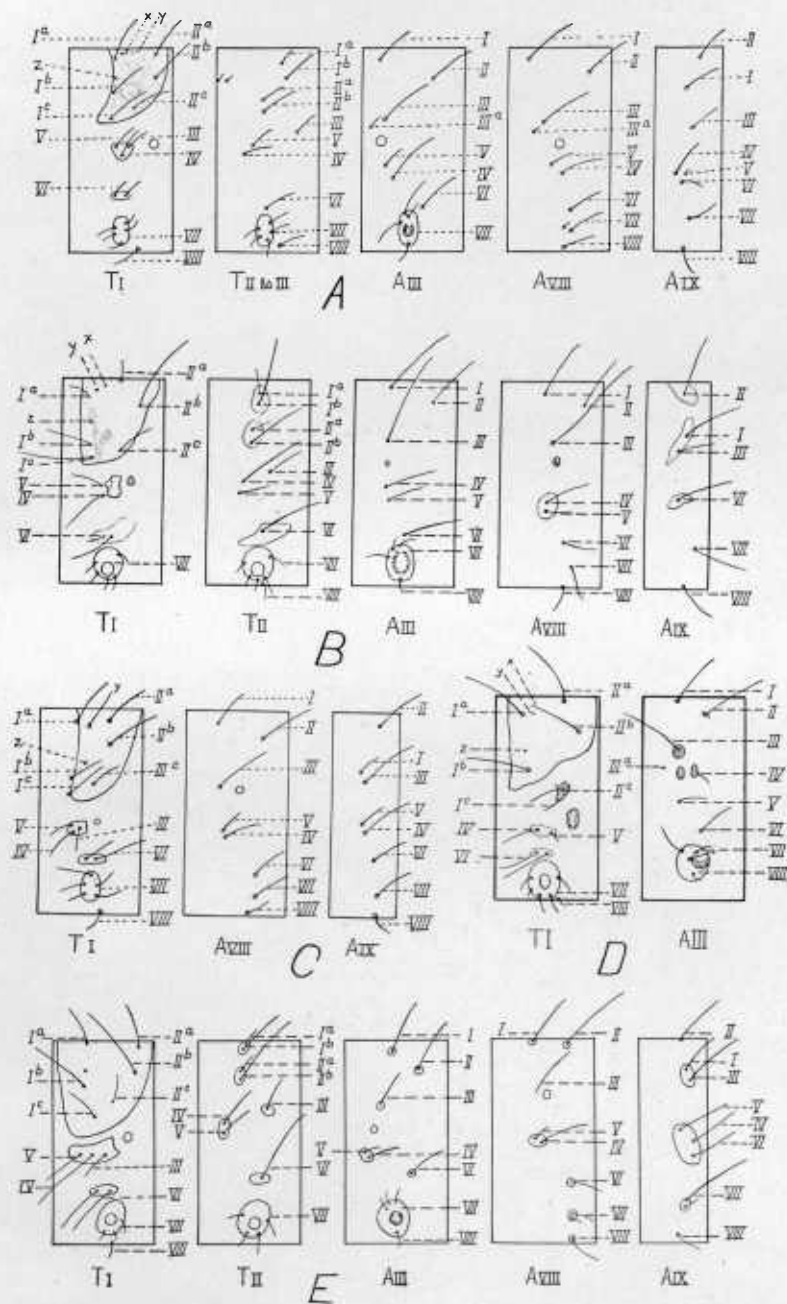
Larval structures:

- A.—*Pyroderces rileyi*: Head capsule, dorsal view, showing arrangement of setæ.
- B.—*P. rileyi*: Head capsule, lateral view, showing arrangement of setæ.
- C.—*Crociosema plebeiana*: Head capsule, dorsal view, showing arrangement of setæ.
- D.—*C. plebeiana*: Head capsule, lateral view, showing arrangement of setæ.
- E.—*Zenodochium citricolella*: Labium and maxillæ.
- F.—*Isophrictis similiella*: Head capsule, dorsal view, showing arrangement of setæ.

PLATE 103

Larval structures:

- A.—*Pectinophora gossypiella*: Setal maps of first and second thoracic and third, eighth, and ninth abdominal segments.
- B.—*Dicymolomia julianalis*: Setal maps of first and second thoracic and third, eighth, and ninth abdominal segments.
- C.—*Pyroderces rileyi*: Setal maps of first thoracic and eighth and ninth abdominal segments.
- D.—*Heliothis obsoleta*: Setal maps of first thoracic and third abdominal segments.
- E.—*Crociosema plebeiana*: Setal maps of first and second thoracic and third, eighth, and ninth abdominal segments.



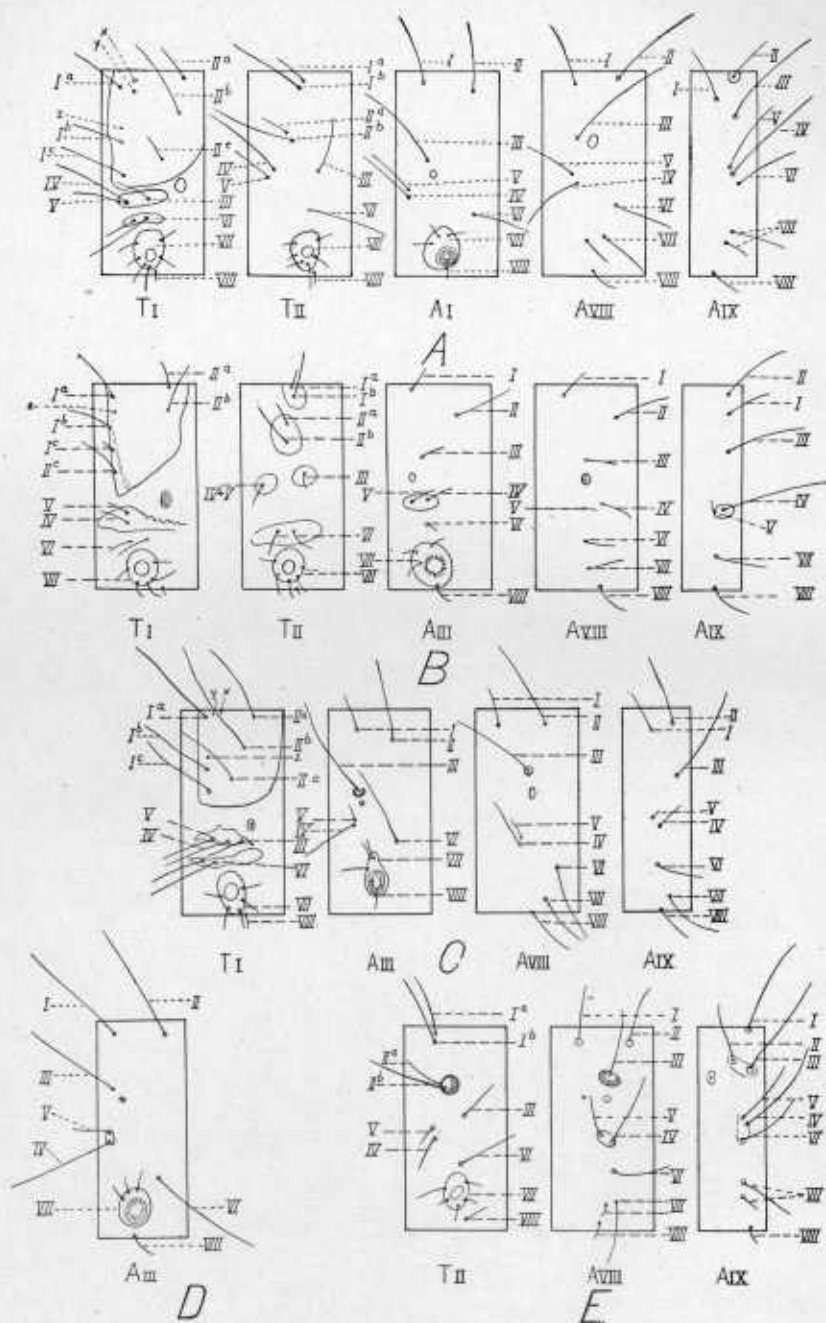


PLATE 104

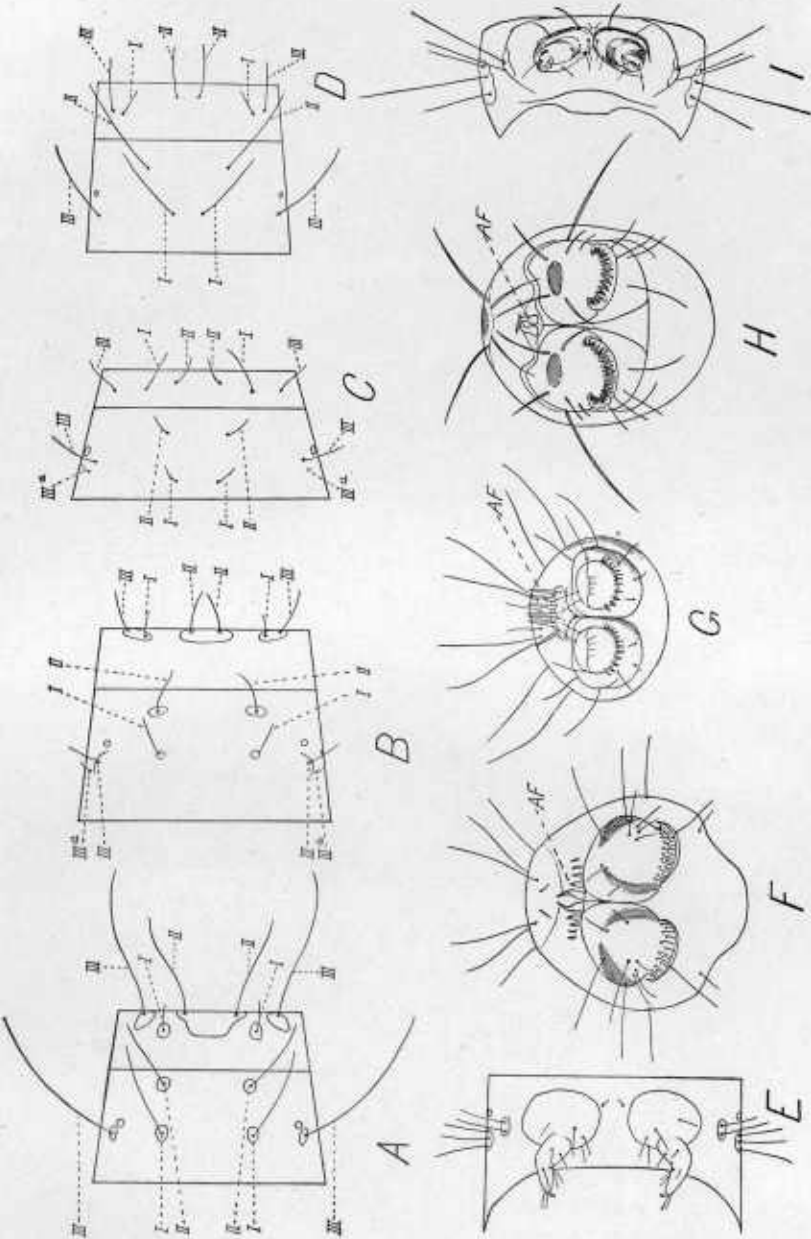
Larval structures:

- A.—*Platynota rostrana*: Setal maps of first and second thoracic and third, eighth, and ninth abdominal segments.
- B.—*Meskea dyspteraria*: Setal maps of first and second thoracic and third, eighth, and ninth abdominal segments.
- C.—*Zenodochium citricolella*: Setal maps of first thoracic and third, eighth, and ninth abdominal segments.
- D.—*Aedemoses haesitans*: Setal map of third abdominal segment.
- E.—*Moodna ostrinella*: Setal maps of second thoracic and eighth and ninth abdominal segments.

PLATE 105

Larval structures:

- A.—*Platynota rostrana*: Setal maps of eighth and ninth abdominal segments, dorsal view.
- B.—*Eucosma helianthana*: Setal maps of eighth and ninth abdominal segments, dorsal view.
- C.—*Pectinophora gossypiella*: Setal maps of eighth and ninth abdominal segments, dorsal view.
- D.—*Pyroderces rileyi*: Setal maps of eighth and ninth abdominal segments, dorsal view.
- E.—*Pectinophora gossypiella*: Prothorax, ventral view, showing position of legs.
- F.—*Telphusa mariona*: Ventro-caudal view of tenth abdominal segment, showing anal fork.
- G.—*Crociosema plebeiana*: Ventro-caudal view of tenth abdominal segment, showing anal fork.
- H.—*Gelechia neotrophella*: Ventro-caudal view of tenth abdominal segment, showing anal fork.
- I.—*Zenodochium citricolella*: Prothorax, ventral view, showing position of legs.





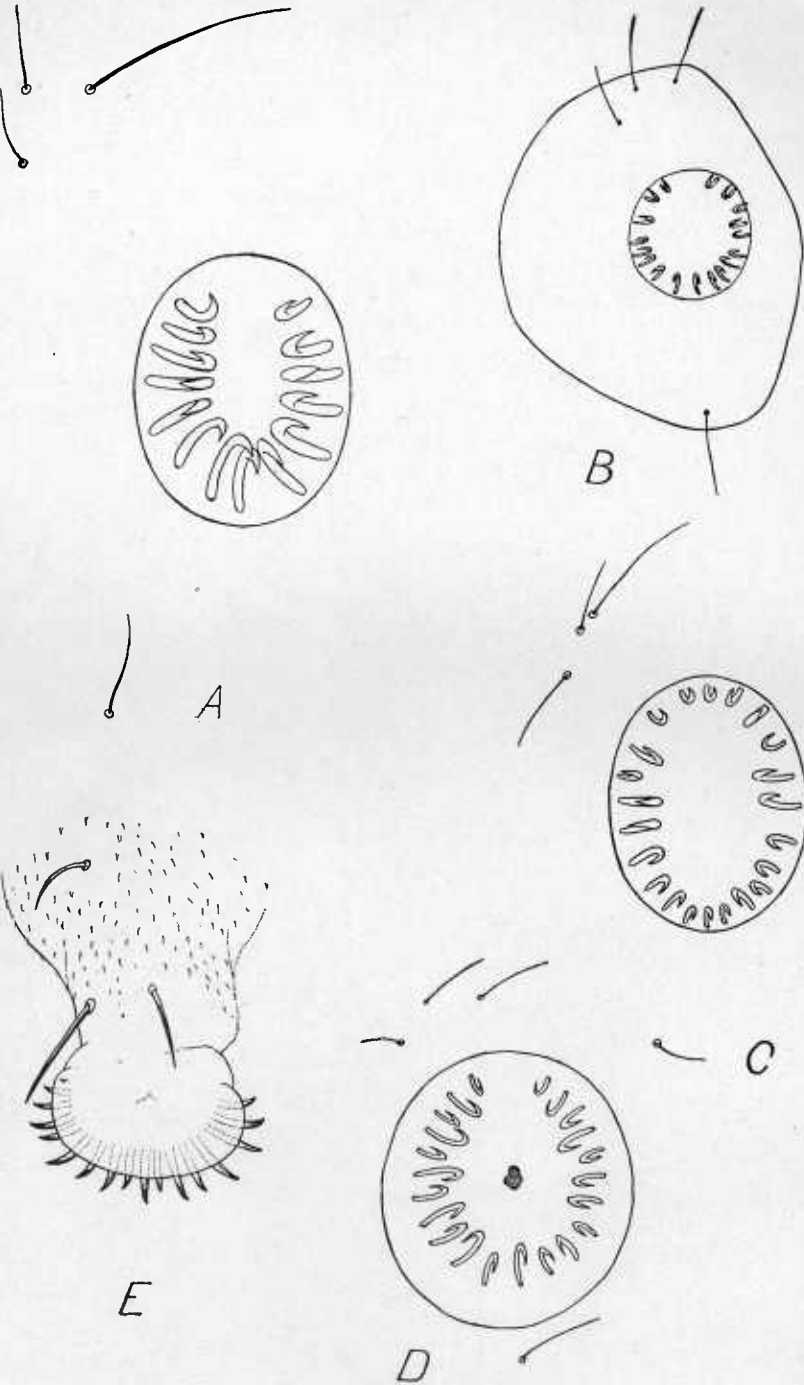


PLATE 106

Larval structures:

- A.—*Pectinophora gossypiella*: Crochet arrangement of abdominal prolegs.
- B.—*Crociosema plebeiana*: Crochet arrangement of abdominal prolegs.
- C.—*Pyroderces rileyi*: Crochet arrangement of abdominal prolegs.
- D.—*Dicymolomia julianalis*: Crochet arrangement of abdominal proleg.
- E.—*Heliothis obsoleta*: Crochet arrangement of abdominal proleg.

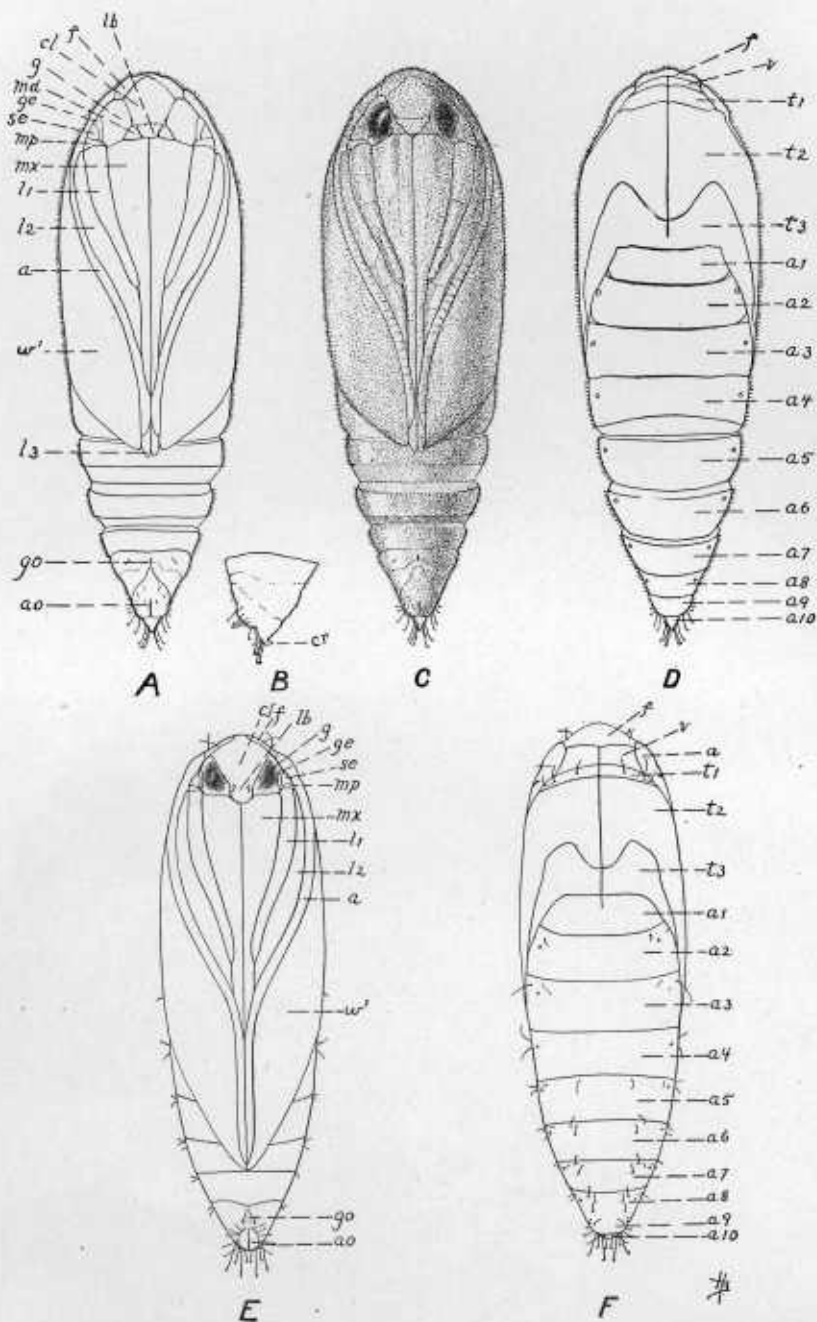
## PLATE 107

### Pupal structures:

- A.—*Pectinophora gossypiella*: Ventral view of pupa.  
B.—*Pectinophora gossypiella*: Caudal end of pupa, lateral view.  
C.—*Pectinophora gossypiella*: Mature pupa, ventral view, shaded to show eyes of imago visible through pupal skin and characteristic pubescence of the pupa.  
D.—*Pectinophora gossypiella*: Dorsal view of pupa.  
E.—*Pyroderces rileyi*: Ventral view of pupa.  
F.—*Pyroderces rileyi*: Dorsal view of pupa.

Explanation of symbols applied to pupæ on Plates 107-109.

- a*=antenna.  
*a*<sup>1</sup> to *a*<sup>10</sup>=abdominal segments 1 to 10.  
*ao*=anal opening.  
*cl*=clypeus.  
*cr*=cremaster.  
*f*=front.  
*f*<sup>1</sup>=femora of prothoracic leg.  
*fcs*=fronto-clypeal suture.  
*g*=gena.  
*ge*=glazed eye.  
*go*=genital opening.  
*lb*=labrum.  
*l*<sup>1</sup>=prothoracic leg.  
*l*<sup>2</sup>=mesothoracic leg.  
*l*<sup>3</sup>=metathoracic leg.  
*lp*=labial palpi.  
*md*=mandible.  
*mp*=maxillary palpus.  
*mx*=maxilla.  
*pf*=pilifer.  
*se*=sculptured eyepiece.  
*t*<sup>1</sup>=prothorax.  
*t*<sup>2</sup>=mesothorax.  
*t*<sup>3</sup>=metathorax.  
*v*=vertex.  
*w*<sup>1</sup>=mesothoracic wing.



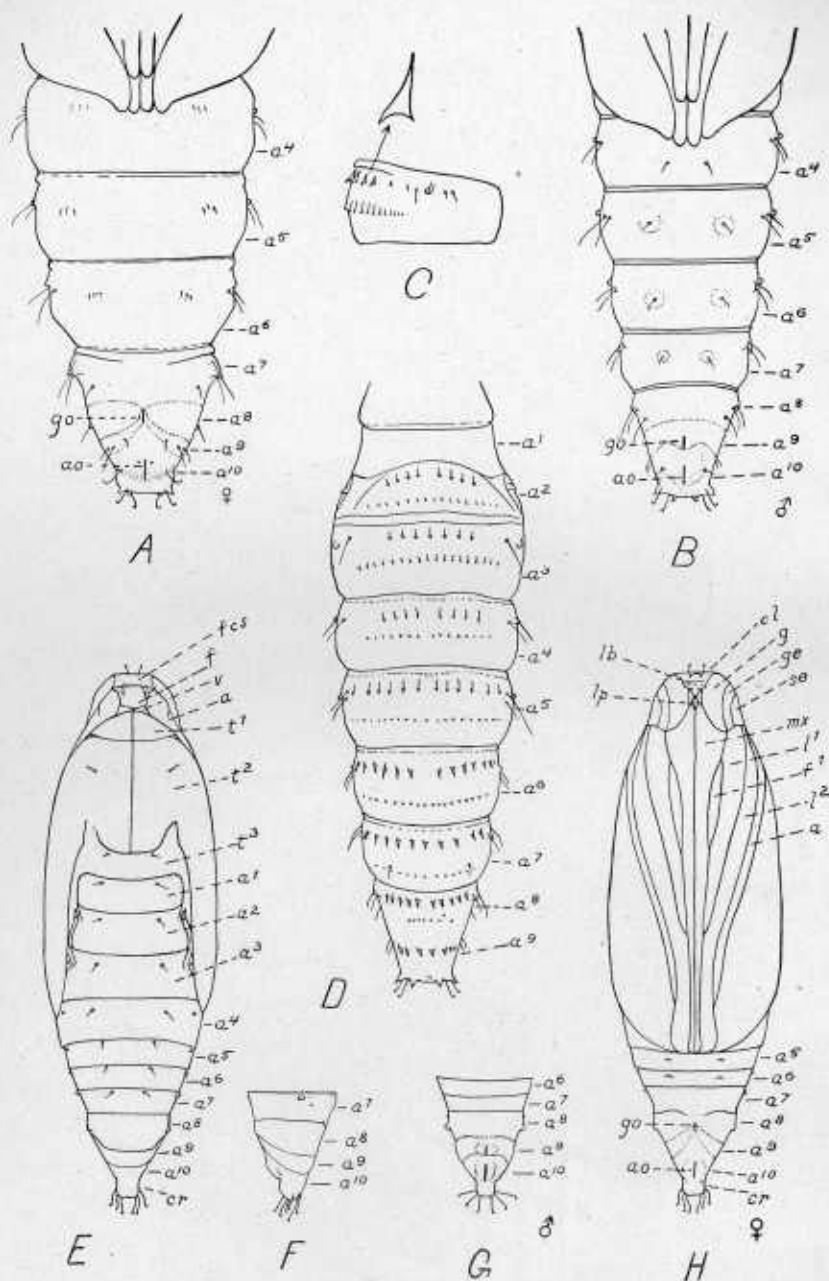


PLATE 108

Pupal structures:

- A.—*Crociosema plebeiana*: Abdomen of female pupa, ventral view.
- B.—*C. plebeiana*: Abdomen of male pupa, ventral view.
- C.—*C. plebeiana*: Lateral view of an abdominal segment, showing arrangement and character of dorsal spines; one spine greatly enlarged to show shape.
- D.—*C. plebeiana*: Abdomen of pupa, dorsal view.
- E.—*Dicymolomia julianalis*: Dorsal view of pupa.
- F.—*D. julianalis*: Caudal end of pupa, lateral view.
- G.—*D. julianalis*: Caudal end of male pupa, ventral view.
- H.—*D. julianalis*: Ventral view of female pupa.

PLATE 109

Pupal structures:

- A.—*Meskea dyspteraria*: Caudal end of female pupa, lateral view.
- B.—*M. dyspteraria*: Abdomen of female pupa, ventral view.
- C.—*M. dyspteraria*: Male pupa, dorsal view.
- D.—*M. dyspteraria*: Caudal end of male pupa, lateral view.
- E.—*M. dyspteraria*: Male pupa, ventral view.
- F.—*Amorbia emigratella*: Abdomen of pupa, dorsal view.
- G.—*Telphusa mariona*: Caudal end of pupa, ventral view, showing peculiarly scalloped and fringed caudal margin of seventh abdominal segment.

